SIEMENS

Transmitter Tubes

Data Book

VX

VX

SIEMENS

Transmitter Tubes Data Book

This data book presents our current range of grid-controlled triodes and tetrodes.

The tubes are intended for use in RF amplifiers in the field of research and development, in amplifier stages of broadcast transmitters for the SW, MW and LW range, in single-sideband communications transmitters, as well as in FM and TV transmitters.

RS 1036 L is especially worth mentioning. With this tube it is now possible to implement aircooled TV transmitters in band IV/V vor up to 20 kW in vision transmission or up to 10 kW / 1 kW in common vision and sound transmission.

We are always available for detailed consulting on technical questions, special applications and reconfiguration of existing amplifiers/transmitters to our series products.

Newly included in this data book:

Type	Application
RS 1036 L	TV transmitters
RS 1092 L	
RS 1092 SK	
RS 1094 L	
RS 2016 CL	FM transmitters
RS 2018 CL	
RS 2068 CL	
RS 2015 CL	Broadcast transmitters
RS 2078 SK	
RS 2048 CJ	RF amplifiers

blank page

148170

blank page

Transmitter Tubes

blank page

Contents

Contents

Contents

Selection Tables

The following tables are intended to facilitate selection of the appropriate tubes for the modes of operation listed below.

The tubes are, of course, also suitable for other applications than those given below. In this case we recommend to use the data sheets or to contact the manufacturer for further information.

Modes of operation:

1. RF amplifiers, telegraphy, pulse operation
2. Anode voltage modulation
3. AF amplifiers and modulators
4. RF linear amplifiers, single-sideband modulation
5. FM and TV transmitters
6. Pulse-duration modulation (PDM) / pulse-step modulation (PSM)

This data books contains all tubes which are recommended for the modes of operation 1 through 6.

Tubes which are particularly suitable for industrial applications are separately dealt with in the data book "Generator Tubes".

1 Transmitter tubes for RF amplifiers, telegraphy, pulse operation

P_2 1) kW	f MHz	f_{max} 2) MHz	Siemens type	Type	$P_{A\,max}$ kW	$U_{A\,max}$ kV	Page
1,7	230	1215	YL 1056	Tetrode	2	3,5	375
9	150	160	RS 2034 CL	Tetrode	12	8	256
11	110		RS 2012 CL	Tetrode	12	9	173
11	110		RS 2064 CL	Tetrode	10	12	323
12	110		RS 2024 CL	Tetrode	12	9	229
12	110		RS 2032 CL	Tetrode	12	9	250
15	50	110	RS 2012 CJ	Tetrode	18	9	173
15	230	300	RS 2026 CL	Tetrode	16	7	236
16	30	110	RS 2014 CL	Tetrode	6	7,5	186
22	30	70	RS 2011 V	Triode	12	11	164
22	110		RS 2068 CL	Tetrode	16	12	328
40	110		RS 2048 CJ	Tetrode	30	13	283
45	30		RS 1081 V	Triode	45	15	82
64	200	220	RS 2058 CJ	Tetrode	90	12	313
75	10	250	RS 1084 CJ	Tetrode	70	16	101
120	10	70	RS 2021 V	Triode	60	16	211
125	110	130	RS 2052 CV	Tetrode	120	12	294
125	200	220	RS 2004 J	Tetrode	120	9	157
165	30		RS 2031 V	Triode	110	12,5	243
190	50	150	RS 2054 SK	Tetrode	120	24	299
220	10	30	RS 2001 K	Triode	110	16	137
330	10	30	RS 2002 V	Tetrode	150	15	147
330	50	170	RS 2042 HF	Tetrode	300	23	270
350	30	60	YL 1490	Tetrode	200	15	395
600	50	110	RS 2074 HF	Tetrode	500	24	333
650	50	110	RS 2078 SK	Tetrode	500	28	348
660	10	30	RS 2041 V	Triode	220	19	262

1) Continuous wave output power; pulse output power upon request.
2) With derated data.

2 Transmitter tubes for anode voltage modulation

P_{trg} kW	f MHz	Siemens type	Type	$P_{A\,max}$ kW	$U_{A\,max}$ kV	Page
5,8	30	RS 2014 CL	Tetrode	5	5	186
6	30	RS 2011 V	Triode	12	6,5	164
10	160	RS 2015 CL	Triode	10	8	194
12	30	RS 2012 CL	Tetrode	12	6	173
12	30	RS 2012 CJ	Tetrode	18	6	173
22	30	YL 1500	Tetrode	15	8	402
22	30	RS 1081 V	Triode	45	10,5	82
55	30	RS 1082 CL	Tetrode	30	10,5	90
55	30	RS 1082 CV	Tetrode	45	10,5	90
66	30	RS 2021 V	Triode	60	11,5	211
66	30	RS 1084 CJ	Tetrode	70	10,5	101
100	30	RS 2001 K	Triode	110	11,5	137
105	30	RS 2054 SK	Tetrode	120	15	299
110	30	RS 2052 CV	Tetrode	120	12	294
212	30	RS 1043 CV	Triode	180	13	64
220	30	RS 2002 V	Tetrode	150	11,5	147
270	30	YL 1490	Tetrode	200	13	395
325	30	RS 2042 SK	Tetrode	300	15	270
330	10	RS 2041 V	Triode	220	11,5	262
400	30	RS 1828	Triode	250	12	126
525	30	RS 2074 SK	Tetrode	500	15	333
540	30	RS 2078 SK	Tetrode	500	13,5	348

3 Transmitter tubes for AF amplifiers and modulators, output power for 2 tubes in push-pull circuit

P_2 kW	Siemens type	Type	$P_{A\,max}$ kW	$U_{A\,max}$ kV	Page
16	RS 2012 CL	Tetrode	12	7	173
16	RS 2012 CJ	Tetrode	18	7	173
17,5	RS 2014 CL	Tetrode	6	7,5	186
20	RS 870	Triode	10	10	37
39	RS 2011 V	Triode	12	11	164
78	RS 2021 V	Triode	60	12	211
80	RS 1081 V	Triode	45	12	82
186	RS 2054 SK	Tetrode	120	15	299
200	RS 876	Triode	75	14	42
230	RS 2001 K	Triode	110	12	137
240	RS 2031 V	Triode	110	12	243
280	RS 2002 V	Tetrode	150	12	147
350	YL 1490	Tetrode	200	15	395
373	RS 2042 SK	Tetrode	300	15	270
410	RS 2041 V	Triode	220	15	262
420	RS 2051 V	Triode	180	12	289
450	RS 1043 CV	Triode	180	13	64
600	RS 2074 SK	Tetrode	500	15	333

4 Transmitter tubes for RF linear amplifiers, single-sideband modulation, carrier suppressed

P_2 kW	f MHz	f_{max} [1] MHz	Siemens type	Type	$P_{A\,max}$ kW	$U_{A\,max}$ kV	Page
9	30	110	RS 2014 CL	Tetrode	6	7,5	186
11	30	110	RS 2012 CL	Tetrode	12	9	173
11	30	110	RS 2012 CJ	Tetrode	18	9	173
12,5	30	110	RS 2794	Tetrode	12	8	354
33	30	110	RS 2795	Tetrode	25	11	360
33	30	250	RS 1082 CL	Tetrode	30	12	90
33	30	250	RS 1082 CV	Tetrode	45	12	90
44	30	250	RS 1084 CJ	Tetrode	70	12	101
110	30		RS 1896	Tetrode	100	15	132
110	30		RS 2002 V	Tetrode	150	15	147

1) With derated data.

5 Transmitter tubes for FM and TV transmitters

P_2 kW	f MHz	Siemens type	$P_{A\,max}$ kW	$U_{A\,max}$ kV	Band, application, circuit	Page
0,22	860	YL 1055	1,8	3,0	TV band IV/V, combined vision-sound amplification	368
0,55	860	YL 1056	2,0	3,5	TV band IV/V, combined vision-sound amplification	375
0,80	230	YL 1055	1,8	3,0	TV band III, sound amplification	368
1,00	230	YL 1056	2,0	3,5	TV band III, vision amplification	375
1,10	860	YL 1057	2,0	3,6	TV band IV/V, combined vision-sound amplification	382
1,10	860	RS 1094 L	4,5	5,0	TV band IV/V, combined vision-sound amplification	119
1,44	230	YL 1058	2,2	3,6	TV band III, sound amplification (two tone)	389
1,70	230	YL 1056	2,0	3,5	TV band III, sound amplification	375
2,20	230	YL 1057	2,0	3,6	TV band III, sound amplification	382
2,20	860	RS 1094 L	4,5	5,0	TV band IV/V, vision amplification	119
2,60	860	RS 1054	5,0	5,0	TV band IV/V, combined vision-sound amplification	70
3,10	860	RS 1054	5,0	5,0	TV band IV/V, sound amplification	70
4,60	860	RS 1054	5,0	5,0	TV band IV/V, vision amplification	70
5,25	860	RS 1092 L	12,5	6,5	TV band IV/V, combined vision-sound amplification	111
5,50	230	RS 2022 CL	12,0	5,5	TV band III, combined vision-sound amplification	222
6,30	860	RS 1034 L	13,0	5,5	TV band IV/V, combined vision-sound amplification	47
10,50	860	RS 1092 SK	25,0	7,5	TV band IV/V, combined vision-sound amplification	111
11,00	860	RS 1092 L	12,5	6,5	TV band IV/V, vision amplification	111
11,00	110	RS 2064 CL	10,0	12,0	FM, grounded grid circuit	323
11,50	860	RS 1036 L	20,0	7,0	TV band IV/V, combined vision-sound amplification	57
12,00	110	RS 2016 CL	12,0	9,0	FM, grounded cathode circuit	198
12,00	110	RS 2018 CL	12,0	9,0	FM, grounded cathode circuit	205
12,00	110	RS 2024 CL	12,0	9,0	FM, grounded cathode circuit	229
12,00	110	RS 2032 CL	12,0	9,0	FM, grounded cathode circuit	250

Transmitter tubes for FM and TV transmitters (continued)

P_2 kW	f MHz	Siemens type	$P_{A\,max}$ kW	$U_{A\,max}$ kV	Band, application, circuit	Page
12,40	860	RS 1034 L	13,0	5,5	TV band IV/V, vision amplification	47
12,60	860	RS 1034 SK	25,0	7,5	TV band IV/V, combined vision-sound amplification	47
16,00	230	RS 2022 CL	12,0	5,5	TV band III, vision amplification	222
22,00	230	RS 2026 CL	16,0	7,0	TV band III, vision amplification	236
22,00	860	RS 1092 SK	25,0	7,5	TV band IV/V, vision amplification	111
22,00	860	RS 1036 L	20,0	7,0	TV band IV/V, vision amplification	57
22,00	110	RS 2068 CL	16,0	12,0	FM, grounded grid circuit	328
25,80	860	RS 1034 SK	25,0	7,5	TV band IV/V, vision amplification	47
26,00	230	RS 1082 CL	30,0	6,0	TV band III, vision amplification	90

6 Transmitter tubes for pulse-duration modulation (PDM) / pulse-step modulation (PSM)

P_2 kW	Siemens type	Type	$P_{A\,max}$ kW	$U_{A\,max}$ kV	Page
125	RS 2054 SK	Tetrode	120	24	299
420	RS 2042 SK	Tetrode	300	28	270
700	RS 2074 SK	Tetrode	500	28	333
700	RS 2078 SK	Tetrode	500	28	348

Equivalent Transmitter Tubes

The tubes listed below can normally be replaced by the equivalent Siemens types. As minor electrical and mechanical variations are possible, it is, however, in any case necessary to compare data, characteristic curves, and surface dimensions of the tubes concerned prior to the exchange. The types in parentheses are nearly equivalent and in most cases may be exchanged unhesitatingly. For some types, minor modifications of the circuit are required. If the Siemens type is not contained in this data book, please contact your nearest Siemens office or representative.

Type	Siemens type	Type	Siemens type
BY 1161	RS 826	SRL 353	(RS 1001 L)
C 1108	(RS 1007)	SRS 456	RS 1002 A
C 1112	(RS 1002 A)	SRS 551	RS 1003
C 1136	RS 1002 A	TBL 12/50	(RS 1031 L)
CQS 50-1	(RS 2054 SK)	TH 290	(RS 1032 C)
CQS 200-3	(RS 2042 SK)	TH 345	RS 2068 CL
CQS 200-3	(YL 1490)	TH 347	RS 1094 L
CQS 400-1	(RS 2074 SK)	TH 361	(RS 2022 CL)
CQS 600-1	(RS 2074 SK)	TH 373	RS 2024 CL
CV 2130	RS 1007	TH 375	RS 2022 CL
CV 2131	(RS 1002 A)	TH 382	RS 1092 L
CV 3879	RS 1002 A	TH 393	(RS 1054 L)
CV 1172	RS 2002 V	TH 399	(RS 2024 CL)
E 125 A	RS 1007	TH 399	(RS 2032 CL)
E 250 A	(RS 1002 A)	TH 477	(RS 1031 V)
Q 160-1	(RS 1007)	TH 479	(RS 1081 V)
Q 400-1	(RS 1002 A)	TH 485	(RS 2021 V)
QB 3/300	RS 1007	TH 547	(RS 1054 SK)
QB 3,5/750	(RS 1002 A)	TH 558	RS 2078 SK
QB 4/1100	(RS 1002 A)	TH 573	(RS 2042 SK)
QY 3-125	RS 1007	TH 581	(RS 2054 SK)
QY 4-250	(RS 1002 A)	TH 582	RS 1092 SK
QY 4-400	RS 1002 A	TT 16	RS 1007
RD 250 VM	(RS 2041 V)	X-2170	(RS 2074 SK)
RE 125 C	RS 1007	X-2203	(RS 2074 SK)
RE 400 C	RS 1002 A	YD 1001	RS 2021 L
RS 683	(RS 1007)	YD 1002	RS 2021 V
RS 685	RS 1007	YD 1032	RS 2001 K
RS 686	(RS 1002 A)	YD 1092	RS 2031 V
RS 865	RS 2001 K	YD 1252	RS 2051 V
RS 875	RS 2031 V	YD 1262	RS 2041 V

Equivalent Transmitter Tubes

Type	Siemens type	Type	Siemens type
YL 1011	RS 1082 CL	3 CX 10000 A7	RS 2015 CL
YL 1012	RS 1082 CV	4-125 A	RS 1007
YL 1091	RS 2002 V	4-250 A	(RS 1002 A)
YL 1100	(YL 1042)	4-400 A	RS 1002 A
YL 1101	YL 1042	4 CW 100000 G	(RS 2058 CJ)
YL 1102	(YL 1042)	4 CX 5000 A	RS 2014 CL
YL 1103	(YL 1042)	4 CX 10000 A	(RS 2024 CL)
YL 1110	RS 1062 C	4 D 21	RS 1007
YL 1181	RS 1012 L	4 F 16 R	YL 1042
YL 1182	RS 1012 V	5 D 22	(RS 1002 A)
YL 1230	(RS 1072 C)	5 F 22	(RS 1002 A)
YL 1280	(YL 1050)	5 F 23	(RS 1002 A)
YL 1380	RS 1032 C	6155	RS 1007
YL 1470	(RS 2024 CL)	6156	(RS 1002 A)
YL 1470	(RS 2032 CL)	6816	(YL 1042)
YL 1520	(RS 2026 CL)	6884	(YL 1042)
YL 1560	(RS 1054 L)	7213	(RS 1072 C)
YL 1570	RS 1084 CJ	7213	(YL 1050)
YL 1580	(RS 1034 L)	7527	RS 1002 A
YL 1610	(RS 2024 CL)	7650	RS 1062 C
YL 1610	(RS 2032 CL)	8438	RS 1002 A
YL 1680	(RS 2058 CJ)	8973	(RS 2074 SK)
YL 1690	(RS 2064 CL)	8985	RS 2064 CL
		8990	RS 2064 CL

Symbols and Terms

Symbols for electrodes

A, a	Anode
F	Heater/filament terminal
F, K	Heater/filament terminal, cathode terminal
F_M	Filament center
G, g	Grid
G1, g1	Control grid
G2, g2	Screen grid
K, k	Cathode

Capacitances

C_{ga}	Capacitance grid/anode
C_{g1a}	Capacitance control grid/anode
C_{g2a}	Capacitance screen grid/anode
C_{g1g2}	Capacitance control grid/screen grid
C_{ka}	Capacitance cathode/anode
C_{kg}	Capacitance cathode/grid
C_{kg1}	Capacitance cathode/control grid
C_{kg2}	Capacitance cathode/screen grid
C_{xy}	Capacitance between the electrodes x and y
$C_{xy/z}$	Capacitance of the electrodes x and y with respect to the electrode z
C_1	Input capacitance
C_2	Output capacitance

Currents

I_A	Anode current (dc)
$I_{A\,0}$	Zero signal anode current (dc)
$I_{A\,M}$	Peak anode current
$I_{A\,p}$	Pulse anode current (dc)
$I_{A\,RMS}$	RMS value of ac anode current
$I_{A\,SW}$	Anode current (dc), black level
$I_{A\,SY}$	Anode current (dc), sync. level
I_{em}	Emission current
I_F	Heater/filament current
$I_{F\,M}$	Max. permissible starting current (peak value)
I_G	Grid current (dc)
$I_{G\,M}$	Peak grid current
$I_{G\,p}$	Pulse grid current (dc)
$I_{G\,RMS}$	RMS value of ac grid current
$I_{G1\,M}$	Peak control grid current
$I_{G1\,p}$	Pulse control grid current (dc)
$I_{G1\,RMS}$	RMS value of ac control grid current
$I_{G1\,SW}$	Control grid current (dc), black level
$I_{G1\,SY}$	Control grid current (dc), sync. level

Currents (continued)

I_{G2}	Screen grid current (dc)
$I_{G2\ p}$	Pulse screen grid current (dc)
$I_{G2\ SW}$	Screen grid current (dc), black level
$I_{G2\ SY}$	Screen grid current (dc), sync. level
I_K	Cathode current (dc)
$I_{K\ M}$	Peak cathode current
$I_{K\ p}$	Pulse cathode current (dc)
I_0	Direct current, average value

Powers

P_A	Anode dissipation
$P_{A\ 0}$	Zero signal anode dissipation
$P_{A\ mod}$	Anode dissipation at modulation
$P_{A\ p}$	Pulse anode dissipation
$P_{A\ SW}$	Anode dissipation, black level
$P_{A\ SY}$	Anode dissipation, sync. level
$P_{B\ A}$	Anode input power
$P_{B\ A\ mod}$	Anode input power at modulation with m = 1
$P_{B\ A\ p}$	Pulse anode input power
$P_{B\ A\ SW}$	Anode input power, black level
$P_{B\ A\ SY}$	Anode input power, sync. level
P_F	Heater/filament power
P_G	Grid dissipation
$P_{G\ mod}$	Grid dissipation at modulation
$P_{G\ p}$	Pulse grid dissipation
P_{G1}	Control grid dissipation
$P_{G1\ p}$	Pulse control grid dissipation
$P_{G1\ SW}$	Control grid dissipation, black level
$P_{G1\ SY}$	Control grid dissipation, sync. level
P_{G2}	Screen grid dissipation
$P_{G2\ p}$	Pulse screen grid dissipation
$P_{G2\ SW}$	Screen grid dissipation, black level
P_{mod}	for m = 1 required modulation power
P_{trg}	Carrier power
P_1	Drive power
$P_{1\ p}$	Pulse drive power
$P_{1\ SW}$	Drive power, black level
$P_{1\ SY}$	Drive power, sync. level
$P_{1\ Ton}$	Drive power, sound
P_2	Output power
$P_{2\ p}$	Pulse output power
$P_{2\ SW}$	Output power, black level
$P_{2\ SY}$	Output power, sync. level

Index of Symbols

Resistances

R_A	Anode load resistance
R_{AA}	Effective load resistance (anode to anode)
R_{ant}	Antenna resistance
$R_{A\ prot}$	Resistance for anode protection
R_G	Grid resistance
$R_{G\ sperr}$	Grid resistance (tube not conducting)
R_{G1}	Control grid resistance
R_K	Cathode resistance

Voltages

U_A	Anode voltage (dc)
$U_{A\ M}$	Peak anode voltage
$U_{A\ p}$	Pulse anode voltage (dc)
$U_{A\ 0}$	Cold anode voltage (dc), tube not conducting
U_{AG}	Anode-grid voltage (dc)
$U_{a\ m}$	Peak anode voltage (ac)
$U_{B\ A}$	Anode input voltage (dc)
U_F	Heater/filament voltage
$U_{F'}$	Preheating voltage
U_G	Grid voltage (dc)
$U_{G\ M}$	Peak grid voltage
$U_{G\ p}$	Pulse grid voltage (dc)
$U_{g\ m}$	Peak control grid voltage (ac)
$U_{g\ m\ p}$	Peak pulse control grid voltage (ac)
$U_{g1\ m\ SY}$	Peak control grid voltage (ac), sync. level
$U_{gg\ m}$	Peak control grid voltage (ac) between grids in push-pull circuitry
$U_{G\ RMS}$	RMS value of ac grid voltage
U_{G1}	Control grid voltage (dc)
$U_{G1\ cut\ off}$	Control grid cut-off voltage
$U_{G1\ fix}$	Control grid bias (dc), fixed
U_{G2}	Screen grid voltage (dc)
U_{KG}	Cathode-grid voltage (dc)
$U_{kk\ m}$	Peak voltage (ac) between cathodes in push-pull circuitry
U_{mod}	Modulation voltage
U_{TR}	Transformer voltage

Index of Symbols

Miscellaneous

a_{IM2}	2-tone intermodulation ratio
a_{IM3}	3-tone intermodulation ratio
B	Bandwidth
D	Duty cycle
d_3	Third order intermodulation products
$d_{3\,2}$	Third order intermodulation products, 2 carriers
d_5	Fifth order intermodulation products
f	Frequency
f_B	Vision carrier frequency
f_{max}	Max. operating frequency
f_p	Pulse repetition frequency
f_{SB}	Sideband frequency
f_{ST}	Interference frequency
f_T	Sound carrier frequency
h	Altitude above sea level
IP_3	Third order intercept point
k	Total distortion
k_p	AM/PM conversion
m	Modulation factor
p_{syst}	Static system pressure, absolute
Q	Coolant flow rate
s	Transconductance
t_A	Anode temperature
t_{amb}	Ambient temperature
t_h	Preheating time
t_K	Cathode temperature
t_p	Pulse period
t_{surf}	Surface temperature
t_0	Pulse break
t_1	Inlet temperature
t_2	Outlet temperature
V_p	Power gain
α	Cold loss
Δp	Pressure drop
η	Anode efficiency
η_p	Pulse efficiency
η_{total}	Total efficiency
μ	Amplification factor
μ_{g2g1}	Amplification factor of screen grid

Commas used in numerical values denote decimal points.

Explanations on Technical Data

1 General information

In order to facilitate quick orientation, each data sheet is preceded by a brief description of construction, cooling and application as well as maximum power and frequency ratings.

Characteristics, capacitances and characteristic curves apply to the average tube. Spread data are supplied upon request.

We recommend the use of the accessories specified for the individual tubes to ensure smooth operation. Detailed information on accessories upon request.

2 Heating

The type of cathode used determines the requirements on stability which have to be met to obtain maximum service life. For this reason the type of heating and the cathode material are always specified in addition to heater voltage and heater current.

2.1 Thoriated tungsten cathodes

The stated heater voltage is the maximum value required by a new tube in order to deliver its rated output power. The maximum permissible deviation from the specified value, caused by temporary fluctuations in the line voltage, must not exceed ± 5 %, unless other tolerances are given in the data sheets. Radiation-cooled tubes (and tubes for industrial generators) in contrast, permit a temporary deviation of + 5/– 10 %.

The heater voltage generally requires stabilization to compensate for possible line voltage fluctuations. If a phase control circuit is used, this should be taken into account when dimensioning the heater transformer (increased rms value of primary current).

To measure the heater voltage for control and adjustment purposes a true rms voltmeter, class 0,5, should be directly applied to the cathode terminals.

A constant deviation of the heater voltage mean value from the specified value, e. g. due to a wrong transformation ratio or a long-term alternation of the mean line voltage (e.g. change from 380 V to 400 V line voltage), must be kept within the limits of + 1/– 3 %. Therefore the primary voltage should be tapped at ± 2,5 % and ± 5 % to ensure appropriate adjustment of the transformation ratio.

The heater current of new tubes may deviate from the rated value within certain tolerances. In addition, the evaporation of the emissive material in the course of the service life leads to a slow increase of the heater current to 15 % of its initial value. This has to be considered when dimensioning the heater transformer.

There must be no RF voltage between the cathode and heater terminals of a directly heated tube. If necessary, a capacitive short circuit has to be provided.

2.2 Oxide cathodes

Overheating of this cathode type results in a rapid emission decrease, whereas underheating causes localized emission on few preferred coating spots, thus damaging the cathode. Furthermore there is the danger of cathode contamination. For oxide cathodes the maximum permissible temporary deviation from the specified value due to line voltage fluctuations must therefore not exceed ± 10 % and the permanent deviation must be within + 1/– 3 %.

Heating up between heater and cathode by RF currents has to be avoided by means of a suitable circuit.

3 Startup

3.1 Switching on the heating and the grid bias voltage

In general, the heating can be switched on at full heater voltage, provided that a heater transformer with standard magnetic stray field is used. The maximum permissible starting current should not exceed 6 times the normal heater current. For some types, however, the permissible starting currents are substantially lower. In some cases the data sheet specifications prescribe a slow increase of the heater voltage until the specified value is reached. These requirements can be met by applying the heater voltage step by step or by providing a motor-driven control transformer or a thyristor transformer on the primary side of the heater voltage transformer. The maximum current to be expected can be calculated from the cathode's cold resistance and the current/voltage dependence of the heater current source. It is easier, however, to determine the peak starting current by use of an oscillograph.

Grid bias voltage and heater voltage may be simultaneously applied, unless no other instructions are given in the data sheets.

3.2 Switching on the anode dc voltage

The anode voltage may only be applied to tubes with external anode and thoriated tungsten cathode after the cathode has reached its operating temperature. This can be checked by means of the heater current. The preheating time, differing from tube to tube but also depending on the internal impedance of the heater current source, is between 2 and 3 seconds. The switching sequence described here must also be maintained in case of power supply failures or operational breakdowns. It is advisable to preheat new tubes or tubes which have been stored for a long time. Generally 15 minutes are sufficient.

For transmitter tubes with external anode, measures should be taken to assure that the anode dc voltage for hardening the tube and tuning the resonant circuits can be applied with at least one intermediate stage. On the other hand, when turning on the tuned transmitter under normal conditions no intermediate stage is required for applying the anode voltage, provided that during the turn-on process the peak voltage (overshoot) does not exceed the maximum permissible anode voltage stated in the data sheets. We therefore recommend to check the turn-on process by means of an oscillosgraph.

Tubes using an oxide cathode must always be preheated for at least 3 minutes before the positive electrode voltages are applied.

For instruction on necessary protection measures in the grid and anode circuits see "Safety precautions".

3.3 Switching on the screen grid voltage of tetrodes

It is essential to apply the screen grid voltage always after the anode voltage. With the help of a voltage-operated relay in the anode circuit it must be assured that the screen grid voltage is switched off at exactly the same moment as the anode voltage. The use of a surge arrester or spark gap between screen grid and cathode is recommended to protect control grid and cathode in case of tube spark-overs.

3.4 Transmitter off-periods

3.4.1 Influencing parameters

Maximum customer benefit is achieved if the costs produced by transmitter off-periods can be minimized. The total costs result from three influencing parameters, which have to be evaluated and optimized.

- Frequent switching of the heating of tubes with thoriated tungsten filament reduces tube lifetime because of the thermal cycling that accompanies this.
- Heating operation of a tube with rated voltage reduces cathode lifetime because of decarburizing of the filaments, since these remain at operating temperature.
- Heating operation causes power costs; these result from the tube heat output and the motor power for blowers and water pumps that is needed for cooling (not with vapor-condensation-cooled tubes).

3.4.2 Constant heating

For optimum tube utilization it is necessary that the full heater voltage (and cooling) is left switched on for up to two hours during transmitter off-periods.

In the case of several short transmitting blocks a day (e.g. four blocks of three hours each) we recommend constant heating (and cooling) throughout the day, as has already been practiced for some time, with success, by a number of large broadcasting stations.

3.4.3 Black heating

Here tubes are heated at such low power during transmitter off-periods that no forced cooling is necessary. This is better in every case than switching off the tube heating entirely, because thermal cycling stays low and there is no drop in emission through decarburization. The tube time meter, which is important for the warranty period, is off during this period.

Black heating should be provided for station breaks of more than two hours in the case of our modern UHF tetrodes. We recommend partial heating for tubes with high UHF heater power.

3.4.4 Partial heating

In cases where there are many long station breaks daily, because of short times on the air, high-power transmitters should be equipped for partial heating, i.e. heating with approx. 60% of normal heating power.

In this procedure the cathode temperature is stepped down far enough so that there is no drop in emission through decarburizatuion. Thermal cycling is reduced substantially by the relatively small temperature jump, compared both to black heating and especially to entire shutdown of the heating. The tube time meter is off during partial heating.

Power costs drop – compared to constant heating – because of the reduced heating power accompanied by the possiblity of cutting back the motors for the coolants.

Please contact us for detailed consultation.

4 Characteristics

The stated emission current I_{em} is the current provided by the cathode when voltage is applied to all other interconnected electrodes. This voltage value is specified in addition to the emission current. Measuring the I_{em} requires special methods to avoid overloading the tube and is therefore reserved to the tube manufacturer. In general, the stated value also represents the maximum current that can be drawn from the cathode during oscillator operation. Values for pulse operation are available upon request.

The amplification factor μ indicates the ratio of an anode voltage change (for tetrodes of a screen grid voltage change) to the control grid voltage change at constant anode current (inverse amplification factor: $D = \mu^{-1}$).

The transconductance s indicates the ratio of an anode current change to the control grid voltage change with all other electrodes at constant voltages. As the characteristic curves of the individual tubes are non-linear and therefore μ and s are no constants, the voltages and anode currents chosen for measuring these two values are quoted.

The values of μ and s are average values, hence deviations may be expected from tube to tube as a result of production variations. The permissible tolerance has been selected such that tubes of the same type can be interchanged. The same applies to the capacitance values. They have been measured at the cold tube and are determined such that the capacitance values of electrodes not used in the measurement have no effect on the result.

5 Modes of operation, maximum ratings and operating characteristics

5.1 General

The various modes of operation under which the tube can be operated demand different characteristics, e. g. with respect to its emission and its electric strength. Maximum ratings are therefore stated for each specific mode of operation. For reasons of service life and reliable tube operation these maximum ratings must not be exceed under any circumstances, for example in case of unbalanced resonant circuits, variable load, or voltage fluctuations. Each maximum rating is an absolute value that must be kept even if all other maximum ratings are not reached.

Of course, the tubes can also be used for operating modes which are not included in this book, provided that the maximum ratings are not exceeded. Operating data are supplied upon request.

5.2 Maximum ratings

The maximum operating frequency has been determined under consideration of the design of the tube. Exceeding these values may damage the electrodes and the glass or ceramic insulators. When determining the maximum operating frequency for a specific tube type, factors such as lead inductances, interelectrode capacitances, electron transit times, capacitive heating of the glass or ceramic parts, and RF voltages are taken into consideration. The data sheets therefore contain different values of the maximum operating frequency in conjunction with corresponding maximum anode voltage values for continuous operation, e. g.

RS 1084 CJ: f_{max} = 10 MHz at U_A = 16 kV;
f_{max} = 40 MHz at U_A = 12 kV.

For pulse operation with high powers (also at high frequencies) the stated power dissipation and ac voltages may be exceeded during the short pulse period. Recommeded operating data upon request.

The maximum ratings of anode dc voltage and grid dc voltage U_A and U_G may depend on operating frequency, electrode spacing for the relevant mode of operation, and dielectric strength of the insulator materials. These ratings must not be exceeded even with an unheated cathode. Particular attention has to be paid to this requirement if the screen grid is connected via a series resistor.

The maximum permissible anode voltage U_A at operation with alternating or unsmoothed voltages is the peak AF value.

The absolute maximum value of dc cathode current I_K is the maximum current that may be drawn during the actual mode of operation. It consists of the dc anode current and all dc grid currents.

The same applies analogously to the peak cathode current $I_{K\,M}$.

The maximum permissible anode dissipation P_A is determined by the permissible thermal loading of the anode. Exceeding this maximum value may lead to an impairment of the vacuum due to outgassing, depositions on insulation paths, melting of the anode body in tubes with external anode, impermissible heating of the glass bulb in radiation-cooled tubes, and thus to damage or total destruction of the tube.

For tubes with external anode the maximum rating stated must not be exceeded, even if the coolant flow rate is increased above the value specified for the permissible power dissipation.

If the maximum coolant flow rate is not available, the reduced maximum rating given in the diagram has to be strictly observed.

For suitable protection measures against thermal overloading of the anode see "Safety precautions".

The maximum admissible control grid and screen grid dissipation P_{G1} or P_{G2} respectively, are likewise determined by the thermal load handling capability. Depending on the mode of operation and operating frequency the maximum grid dissipation will have different values to allow for additional grid heating due to RF current. Therefore, particular attention should be given to this rating.

The dc electrode voltages stated under maximum ratings and operating characteristics are referred to the cathode unless otherwise denoted by additional indices. The quoted ac voltages are always peak values (e. g. $U_{g\,m}$).

5.3 Operating characteristics

The specified operating characteristics for the individual modes of operation represent recommended settings for optimum utilization of the tube; the maximum ratings are observed with due regard to a practical safety margin. The operating characteristics are based on precise calculations according to the measured characteristic curves of average tubes, which have been confirmed by measurements during operation in testing laboratories and by the user.

The output power P_2 gives the power available at the tube output for amplifier operation. It can be calculated by subtracting the anode dissipation from the anode input power (dc power):

$P_2 = P_{B\,A} - P_A = U_A\ I_A - P_A$.

The actual RF output power is then reduced by the losses of the output circuit; it can be determined calorimetrically by means of an effective resistor which converts the power into heat. The formula is the same as for the determination of P_A, see below.

The values specified for P_2 usually do not include circuit losses. If circuit losses are taken into account, this is stated in the footnote.

The drive power P_1 required by the grid to control the tube can be approximately calculated by the grid ac voltage and the grid dc current:

$$P_1 \approx (0{,}92 \text{ to } 0{,}95)\; U_{G1m}\; I_{G1}.$$

For class B operation the smaller multiplying factor should be chosen and for class C operation the greater one.

The anode dissipation P_A can be determined calorimetrically from the temperature rise and the flow rate of the cooling agent:

$P_A = 0{,}070\,(t_2 - t_1)\,Q_W$ (water cooling, vapor condensation cooling),

$P_A \approx 0{,}018\,(t_2 - t_1)\,Q_L$ [1]) (air cooling).

P_A in kW results from the temperature rise in °C and the water flow rate in l/min or the air flow rate in m^3/min.

The anode dissipation of radiation-cooled tubes can be measured pyrometrically. The anode temperature for the intended operation is compared with that in static operation. This measurement is especially recommended when new equipment is designed.

The screen grid dissipation P_{G2} is the product of the screen grid dc voltage and the mean value of the screen grid current. If the screen grid also carries ac voltage, then the momentary values of voltage and current are required.

The control grid dissipation P_{G1} is the difference between the drive power and the power supplied by the grid voltage source and can be approximated by the formula:

$P_{G1} = P_1 - |U_{G1}|\; I_{G1}$ (P_1 determined by approximation, see above).

The direct calculation of P_{G1} from the characteristic curves is based on the mean value of the momentary products of control grid voltage and current. The result can then be used for a reliable calculation of the drive power:

$$P_1 = P_{G1} + |U_{G1}|\; I_{G1}$$

The efficiency η is the percentage ratio of the tube output power P_2 to the anode input power $P_{B\,A}$.

When operating the tube in grounded grid circuit, considerably more power is required from the driver stage than with grounded cathode circuit; however, this extra power is transferred completely to the output circuit and adds to the tube output power. This RF power supplied by the driver stage is called transition power and is specified in the relevant data sheets for both P_1 and P_2 as separate term of the sum.

1) Valid with a max. error of ± 5 %, if at 1 bar air pressure the average cooling air temperature $(t_1 + t_2)/2$ lies between 39 °C and 72 °C.

For an amplifier in grounded grid circuit the total output power is consequently greater by the factor $1 + U_{g1\,m} / U_{a\,m}$. When calculating the tube efficiency in this case, the transition power must not be added to the tube's output power.

The anode load resistance R_A is the ac resistance required for safe loading under the given operating mode. The load resistance must satisfy the equation $R_A = U_{a\,m}^2 / 2\,P_2$ in order to obtain the correct anode ac voltage $U_{a\,m}$ at the desired power P_2.

Deviations from the quoted value usually lead to a deterioration of the operating conditions with regard to power or efficiency or may also lead to exceeding the maximum ratings. An RF output transformer or a transforming network of reactance resistors can provide low-loss matching of the given load resistance to the target value R_A.

With grounded cathode circuit R_A is located between anode and cathode and with grounded grid circuit between the tube's anode and grid.

In case of sinusoidal modulation the modulation factor m is the ratio of the amplitude of the modulating AF voltage to the voltage amplitude of the carrier. It is most conveniently measured by means of an oscilloscope. In case of anode voltage modulation via a modulating transformer the value P_{mod} indicates the power to be supplied by the modulator for $m = 1$, i. e.

$$P_{mod} = \frac{m^2}{2} P_{B\,A} = \frac{1}{2} P_{B\,A}.$$

$P_{B\,A}$ is the anode input power of the RF stage with unmodulated carrier.

6 Mounting and connection

6.1 Mounting position

Transmitter tubes are usually mounted vertically with the anode up or down, according to the instructions given for the individual types. Exceptions are some types with oxide cathodes, which can be mounted in any position.

6.2 Mounting and removal

Mounting and removal of transmitter tubes have to be carried out with particular care to avoid any damage to the cathode or the fragile parts of the vacuum envelope. By all means, any shock or impact has to be avoided. This also applies to defective tubes, if they are subject to claims under warranty.

For the same reasons the connectors and particularly the large header sockets must be mounted on the tube with utmost care and under smooth and uniform pressure.

7 Cooling

7.1 Maximum tube surface temperature

During operation the tube is heated by the heater or filament and the power dissipated by grid and anode. Cooling keeps the heating effect within bounds and avoids damage due to overheating.

In order to determine whether the temperature is maintained within the limits stated for each type of tube, temperature measurements have to be carried out under worst-case operating conditions with respect to temperature rise. This is particularly important when new equipment is put into operation. Calibrated thermocouples or temperature indicators (thermocolor paints and similar), for example, can be used for measuring the tube surface temperature.

7.2 Forced-air cooling

Forced-air-cooled tubes have a metallic external anode, the outer surface of which is enlarged by cooling fins. The cooling air, which is filtered to prevent contamination, is either blown or sucked through this radiator.

The minimum air flow rate Q required for a certain anode dissipation P_A, the pressure drop in the radiator Δp and the air outlet temperature t_2 are given in the cooling air diagrams contained in the data sheets. The curves apply to an air inlet temperature t_1 of 25 °C, a normal air pressure of 1 bar, and air supply from the side of the terminals.

Operation at air inlet temperatures above 25 °C is possible if the same outlet temperature can be maintained by increasing the air flow rate which results in a correspondingly lower temperature rise. With inlet temperatures below 25 °C the air flow rate should however not be reduced.

For operation at high altitudes above sea level the cooling air flow rate should be increased inversely proportional to the decrease in air pressure; for example 13 % at 1000 m altitude or 45 % at 3000 m.

With reverse cooling air direction, i. e. from the anode base, cooling of the tube terminals is less effective so that at the most only 85 % of the normally permitted anode dissipation is allowed.

For high-power tubes or for RF operation it may be necessary to provide suitable air ducts in the region of the tube terminals or a separate flow of cooling air on the terminal side of the tube, in order to keep within the temperature limits.

When using cavity circuits it should be ensured that sufficient space is provided between the individual springs of the contact ring for the passage of cooling air.

The air flow and the outlet temperature should be monitored by means of a trip circuit which disconnects the voltages applied to the tube, including the heater voltage, in case of operational malfunction.

The deciding factor for the setting of these trip circuits and for the dimensioning of the radiator is always the maintenance of the maximum permissible temperature.

7.3 Water cooling

Water-cooled tubes (J types) are fitted with a cooling jacket, which forms a unit with the anode. This design has replaced the older type with separate cooling jacket because of its advantages of lower cooling water requirement and more simple construction.

The water inlet and outlet pipes must be insulated. In order to avoid electrolytic corrosion, it is recommended that our "LL electrolytic target" is used for the water connections on the anode side.

The water stream is directed to flow upwards along the hot anode wall. If the tube is mounted anode-down, the arrows next to the water connections show the direction of water flow. If the tube is mounted anode-up, then the cooling water must flow in the opposite direction to the arrows.

In order to prevent damage to the tube as a result of mineral deposits on the anode, it is recommended to use a closed cooling cycle filled with distilled or deionized water. This cooling cycle is to be connected via a heat exchanger to a series-connected cooling system. The cooling water diagrams given for the individual types of tube apply to distilled or deionized water, especially those diagrams which are provided for water inlet temperatures of 35 °C with regard to operational considerations and cost-saving dimensioning of the heat exchanger.

The minimum water flow rate Q for a given anode dissipation P_A as well as the water outlet temperature t_2 and the pressure drop Δp can be read from the cooling water diagrams.

The maximum water outlet temperature is 65 °C when distilled water is used. The maximum permissible pressure of the cooling water is 5 bar, if not otherwise specified (overpressure).

For cleaning of the cooling system from mineral deposits 10 % citric acid solution should be used, which is left for a few hours in the system to take effect. The cleaning work has to be carried out with great care since the cathode of the tube is very sensitive to shock.

If the primary anode cooling circuit contains corrodable foreign materials such as iron or zinc alloys (this should be avoided in new systems), the oxygen content of the water that causes corrosion or dezincing can be bound by adding 15 % diamine hydrate. The products of the reaction are only pure water and nitrogen. Approximately 1 ml of solutions is required to 1 l of water.

It is recommended to check the quality of the circulating cooling water after starting operation and at regular intervals by measuring the electrical conductivity ($\leq$ 50 µS/cm) and the hydrogen ion concentration (pH value 7 to 9).

The water pumps must be switched on latest with the tube heating. The flow rate and the water temperature must be automatically monitored during operation. When the flow rate drops below a certain value the tube electrode voltages, including the heater voltage, must be disconnected automatically. The same applies if the maximum admissible water outlet temperature is exceeded. After-cooling is normally not necessary after the equipment has been switched off.

Additional air cooling of the tube's terminal side is necessary to keep the temperature within the specified limits. The given air flow rates are recommended values; the decisive factor is always the maintenance of the maximum permissible temperature.

7.4 Vapor cooling

Vapor cooling makes use of the fact that a thermal energy of 2260 kJ is necessary to convert 1 l of water with a temperature of 100 °C into steam of the same temperature. The required heat is taken from the anode, which is cooled by this effect.

The data sheets include detailed information on the total dissipated power, on the amount of water vaporized per unit time and on the volume of vapor produced at various coolant inlet temperatures in the boiler (returning water temperature). Distilled or deionized water should be used as coolant. In the time period immediately after starting operation the total water contents are to be exchanged repeatedly until the equipment and the pipe network are purged from unavoidable contamination. The cooling water should be exchanged as part of servicing, if the specific resistance falls during the operation of the equipment to below 20 kΩcm or if the conductivity increases to over 50 µS/cm.

The maximum permissible anode dissipation given in the data sheets for vapor-cooled tubes can only be regarded as ensured if even traces of contaminants in the cooling water are avoided, e. g. organic matter such as oil and grease.

Siemens supplies accessories that were especially developed for vapor cooling. The use of these accessories is imperative for trouble-free equipment operation.

Additional cooling of the grid and cathode terminals by means of an adequate air flow is required for keeping the temperature within in the specified limits. The given air flow rates are recommended values; the deciding factor is always the maintenance of the maximum permissible temperature.

The header sockets supplied as accessories should be provided with a connection for cooling air.

7.5 Vapor condensation cooling

The vapor condensation method is a combined steam/water cooling method. The coolant cycle, which is normally hermetically closed, and the special structure of the anode surface enable a more efficient removal of the dissipation heat than the previously used cooling methods. For each kilowatt of dissipation power approx. 0,5 l/min of distilled or deionized circulating water is required (conductivity ≤ 50 µS/cm).

If the cooling water has a permanent overpressure of 1,5 bar, the temperature of the water outlet may be up to 100 °C. The prescribed safety fuse must respond to an overpressure of 2 bar. For the vapor condensation system the relation between the anode dissipation P_A, the minimum water flow rate Q, the pressure drop Δp between the water connections and the water outlet temperatures t_1 = 60 °C, 65 °C or 70 °C are given in the cooling water diagram for the tube.

Operation with open cooling cycle, i. e. without overpressure, is also possible if it is ensured that with normal external air pressure of ≈ 1 bar the water outlet temperature cannot exceed 70 °C. This can be achieved using an appropriately lower water intake temperature and, if necessary, an increased cooling water flow rate.

The cooling system comprises a cooling water pump, the tube to be cooled in the SK version, a heat exchanger and a reservoir vessel and, additionally for operation under pressure, a pressure equalizing vessel, which can be combined with the reservoir vessel, as well as devices for operational and monitoring tasks. Impermissible increases in pressure due to fault conditions are avoided by the 2 bar overpressure safety valve.

The water inlet and outlet pipes must be insulated. In order to avoid electrolytic corrosion, it is recommended that our "LL electrolytic target" is used for the water connections on the anode side (accessory).

The prescribed direction of water flow is indicated by arrows; it is not dependent on the mounting position of the tube.

The water pumps must be switched on at the same time as the tube heating. Additional cooling of the tube terminals is necessary for keeping the temperatures within the specified limits. The air flow rates given in the data sheets are recommended values; the deciding factor is always the maintenance of the maximum permissible temperature.

The water flow rate and the water outlet temperature should be monitored by automatic trip circuits so that all voltages applied to the tube, including the heater voltage, are switched off under fault conditions.

To facilitate tube exchange without loss of cooling water the larger tubes of the SK series have a threaded joint for connection of a drain pump.

8 Safety precautions

Transmitter tubes must be equipped with certain protective devices, which comprise automatic safety and trip circuits to prevent the tube from being damaged in case of malfunction. Claims under warranty can only be asserted if these safety devices have been provided.

For tetrodes in amplifier operation it has to be ensured by means of an interlocking circuit that (after switching on the cooling system of tubes with separate cooling) the operating voltages are applied in the following sequence: heater voltage and grid bias – anode voltage – screen grid voltage – control grid ac voltage.

In addition to the relatively slow anode overcurrent trip circuit a high-speed trip circuit for the anode voltage is required to protect the tube in case of sparkovers.

The effectiveness of the high-speed trip circuit can be checked by means of a copper test wire of a given diameter (see table 1, next page). For this purpose the applied anode voltage is short-circuited by the copper wire directly at the tube terminals. If the wire does not fuse, the trip circuit meets the requirements. The remaining electrodes should be tested in the same way (each electrode to each other).

With the aid of the value I^2t, which is additionally included in table 1, it is possible to check by calculation whether the trip circuit works properly, provided that the time characteristic of the short-circuit current is known or can be estimated.

The integral $\int I^2 dt$ over the time in which short-circuit current flows through the tube must not be greater than the value I^2t in the table.

In general, the above requirements will only be met if a short-circuiting device such as an ignitron is connected in parallel with the tube. This device assures a rapid removal of the voltage and, if necessary, a fast discharge of the smoothing capacitor via this parallel path.

In case of power supplies with smoothed anode voltage, apart from this measure the anode circuit must include an appropriately dimensioned series protection resistor that, in case of sparkover, absorbs the larger part of the energy stored in the smoothing capacitor and assures compliance with the test wire requirements.

For modulator operation the protection of the tube is already given by the fact that with the use of a common power supply for RF stage and modulator the current rise in the modulator tubes is also monitored. When the set threshold is reached, the short-circuit devices, e. g. ignitrons, are triggered and the power supply is switched off.

The anode voltage may only be applied again after a stabilization time of at least 100 ms.

Table 1 Copper wire diameters for checking the high-speed trip circuit

Type	I^2t A^2s	Test wire dia. (mm)	Type	I^2t A^2s	Test wire dia. (mm)
RS 870	95	0,20	RS 2015 CL	95	0,20
RS 876	230	0,25	RS 2016 CL	95	0,20
RS 1034	12	0,12	RS 2018 CL	95	0,20
RS 1036 L	12	0,12	RS 2021 V	270	0,26
RS 1043 CV	270	0,26	RS 2022 CL	95	0,20
RS 1054	12	0,12	RS 2024 CL	95	0,20
RS 1081 V	270	0,26	RS 2026 CL	95	0,20
RS 1082 C	95	0,20	RS 2031 V	200	0,24
RS 1084 CJ	95	0,20	RS 2032 CL	95	0,20
RS 1092 L, SK	60	0,18	RS 2034 CL	95	0,20
RS 1094 L	12	0,12	RS 2041 V	500	0,30
RS 1828	230	0,25	RS 2042	1500	0,40
RS 1896	140	0,22	RS 2048 CJ	230	0,25
RS 2001 K	270	0,26	RS 2051 V	270	0,26
RS 2002 V	500	0,30	RS 2052 CV	500	0,30
RS 2004 J	95	0,20	RS 2054 SK	500	0,30
RS 2011 V	95	0,20	RS 2058 CJ	230	0,25
RS 2012 C	95	0,20	RS 2064 CL	95	0,20
RS 2074	900	0,35	RS 2068 CL	95	0,20
RS 2078 SK	900	0,35	YL1056	6	0,10
RS 2794	95	0,20	YL1057	12	0,12
RS 2795	95	0,20	YL1058	12	0,12
YL1055	6	0,10	YL1490	500	0,30
RS 2014 CL	95	0,20	YL1500	95	0,20

Length of test wires: approx. 20 mm per 1000 V of applied anode voltage.

For tetrodes the use of a spark gap or surge arrester between screen grid and cathode is recommended, to protect the control grid and cathode from damage by sparkovers from the anode. To prevent overloading of the screen grid due to wrong transmitter setting or faults at the transmitter output, an overcurrent relay should be provided in the screen grid supply, which automatically switches off the screen grid voltage.

In order to prevent a stationary arc discharge between control grid and cathode, which is fed by the grid current supply, the control grid circuit must be designed such that the grid dc current circuit becomes high-ohmic ($R \geq 5$ kΩ) in the event of tube sparkover, e. g. by the opening of a contact in the anode current circuit high-speed relay. Additional protection can be achieved if this series resistor can also be connected via an overcurrent relay in the grid circuit. The protective resistor may be switched off only after a stabilization time of 100 ms.

To protect the anodes of air-cooled and water-cooled tubes against thermal overloead, tube fuses have been developed which, in conjunction with a pull switch, automatically switch off anode and heater voltage. Note that the tube fuse (RöSich4) in vapor-cooled tubes serves primarily as a protection against excessive water level drop in the boiler. It is no general protection against thermal overloading of the anode, since local overheating may occur on the side opposite to where the fuse is screwed into the anode.

Information on the appropriate tube fuses is given in the data sheets on the individual tubes.

Irrespective of the use of these fuses, the instructions on automatic monitoring of coolant flow rate and temperature given in the previous sections on cooling have to be observed for all tubes with separate cooling.

An automatic monitoring device is also required for additional cooling of the tube terminals by a separate radiator.

9 Notes on possible dangers

Irregularities in the operation of transmitter tubes and equipment or improper handling of them can produce the following risks. All persons involved should be instructed on the possible risks and act accordingly.

9.1 High voltage

Transmitter tubes are usually operated on high voltages, meaning that the following points should be carefully observed:

a) Follow all safety regulations applying to work with high-voltage apparatus.

b) Make sure that cavity resonators are properly grounded.

c) A tube should only be replaced when its voltages are switched off. It is advisable to provide automatic voltage cutout with forced grounding of all conductive parts.

9.2 RF radiation

Exposure of the human body to RF radiation should be kept as low as possible, and the vicinity of antennas and open RF connectors in particular should be avoided. Never look into open RF connectors, there is the risk of damage to the eyes. All RF leads should be closed and tight. A check for tightness of leads should be made after first-time startup and service work. Make sure that national regulations are adhered to.

9.3 X-rays

High-vacuum tubes that are operated on voltages of more than 5 kV are to be considered as sources of spurious radiation.

The dose rate of X-rays will depend on the construction of a tube and the maximum operating voltage, measurable dose rates generally not occurring until voltages exceed 20 kV.

Measured data on the different types of tube will be sent to you on request. The operation of our tubes is governed by the X-ray regulations of 8 January 1987 and the relevant national regulations.

9.4 Implosion

Electron tubes are evacuated and can implode if they are subjected to excessive mechanical stress. In such cases tubes with a large vacuum vessel represent a danger to the operating personnel because of the splinters and parts that can fly around. There is no danger of this kind with television tubes.

9.5 High temperatures

The tubes and their cooling devices can reach very high surface temperatures, which can persist long after a tube is switched off. Contact with these hot surfaces or with coolants if there is a break in the cooling system can lead to burns; make sure that appropriate preventive measures are taken.

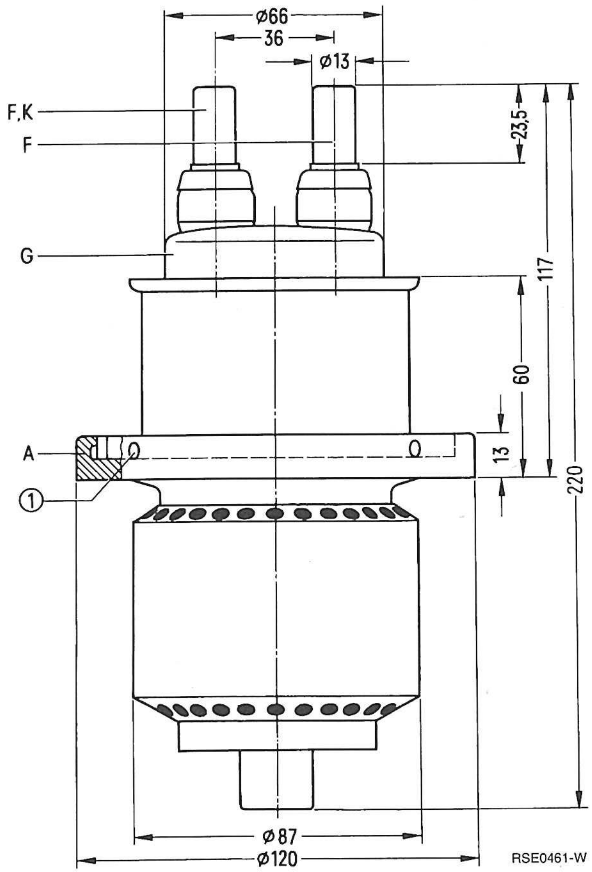
10 Conversion of pressure values

1 bar	approx. 1 at = 1 kp/cm^2
1 mbar	= 100 Pa approx. 1 cm water column
1 Torr	= 1 mm Hg = 1,3332 mbar
1 psi	approx. 69,00 mbar
1 ft H_2O	approx. 29,90 mbar
1 in H_2O	approx. 2,49 mbar
1 in Hg	approx. 33,90 mbar

blank page

Ordering code Q53-X870

Vapor-cooled triode with coaxial grid lead-through, particularly suitable for modulators of 10 kW to 25 kW transmitters.



Dimensions in mm

① Tapholes for handle RöZub833

Approx. weight 3,5 kg

Heating

Heater voltage	U_F	5,0	V
Heater current	I_F	≈ 80	A
Permissible starting current	$I_{F\,M}$	≤ 180	A
Heating: direct			
Cathode: thoriated tungsten			

Characteristics

Emission current at $U_A = U_G = 300$ V	I_{em}	15	A
Amplification factor at $U_A = 3$ to 6 kV, $I_A = 1$ A	μ	16	
Transconductance at $U_A = 5$ kV, $I_A = 1$ A	S	22	mA/V

Capacitances

Cathode/grid	c_{kg}	≈ 55	pF
Cathode/anode	c_{ka}	≈ 2,0	pF [1])
Grid/anode	c_{ga}	≈ 27	pF

Accessories		Ordering code
Cathode terminal (2 for each tube)	RöKat534	Q1001-X7
Grid terminal	RöGit533	Q1001-X15
Handle	RöZub833	Q1001-X100
Boiler	RöKüV833	Q1001-X35
Water level stabilizer with control electrodes	RöZubV4	Q81-X2105
LL electrolytic target	RöEl40	C65055-A667-A40
Gasket ring for boiler		C65055-A620-C591
Gasket ring for water supply line		C65055-A620-C592
Gasket ring for vapor outlet		C65055-A620-C593

1) Measured by means of a 50 cm diameter screening plate in the grid terminal plane.

AF amplifier and modulator,
class B operation, 2 tubes in push-pull circuit

Maximum ratings

Anode voltage (dc)	U_A	10	kV
Grid voltage (dc)	U_G	– 900	V
Cathode current (dc)	I_K	4,0	A
Peak cathode current	I_{KM}	15	A
Anode dissipation	P_A	10	kW
Grid dissipation	P_G	100	W

Operating characteristics at modulator operation for

		25 kW carrier power		20 kW carrier power		
Output power	P_2	0	20	0	16	kW
Anode voltage (dc)	U_A	7,5	7,5	6,0	6,0	kV
Grid voltage (dc)	U_G	– 460	– 460	– 370	– 370	V
Peak control grid voltage (ac) between the 2 tubes	$U_{gg\,m}$	0	1160	0	1000	V
Anode current (dc)	I_A	2 × 0,2	2 × 2,2	2 × 0,2	2 × 2,2	A
Grid current (dc)	I_G	0	2 × 0,1	0	2 × 0,12	A
Peak grid current	I_{GM}	0	2 × 0,7	0	2 × 0,8	A
Anode input power	P_{BA}	2 × 1,5	2 × 16,5	2 × 1,2	2 × 13,2	kW
Drive power	P_1	0	2 × 55	0	2 × 60	W
Anode dissipation	P_A	2 × 1,5	2 × 6,5	2 × 1,2	2 × 5,2	kW
Grid dissipation	P_G	0	2 × 12	0	2 × 15	W
Efficiency	η	–	60	–	60	%
Effective load resistance (anode to anode)	R_{AA}	–	3360	–	2640	Ω

Tube mounting

Axis vertical, anode down.

For connection of the tube use the terminals listed under "Accessories".

Maximum tube surface temperature

The temperature of the glass-to-metal seals must not exceed 200 °C at any point. The maximum permissible temperature between grid and anode is 220 °C. If necessary, the glass bulb must be additionally cooled by a slight air flow. At the metal-to-ceramic seals of heater and cathode lead-throughs the temperature should not exceed 200 °C.

Vapor cooling

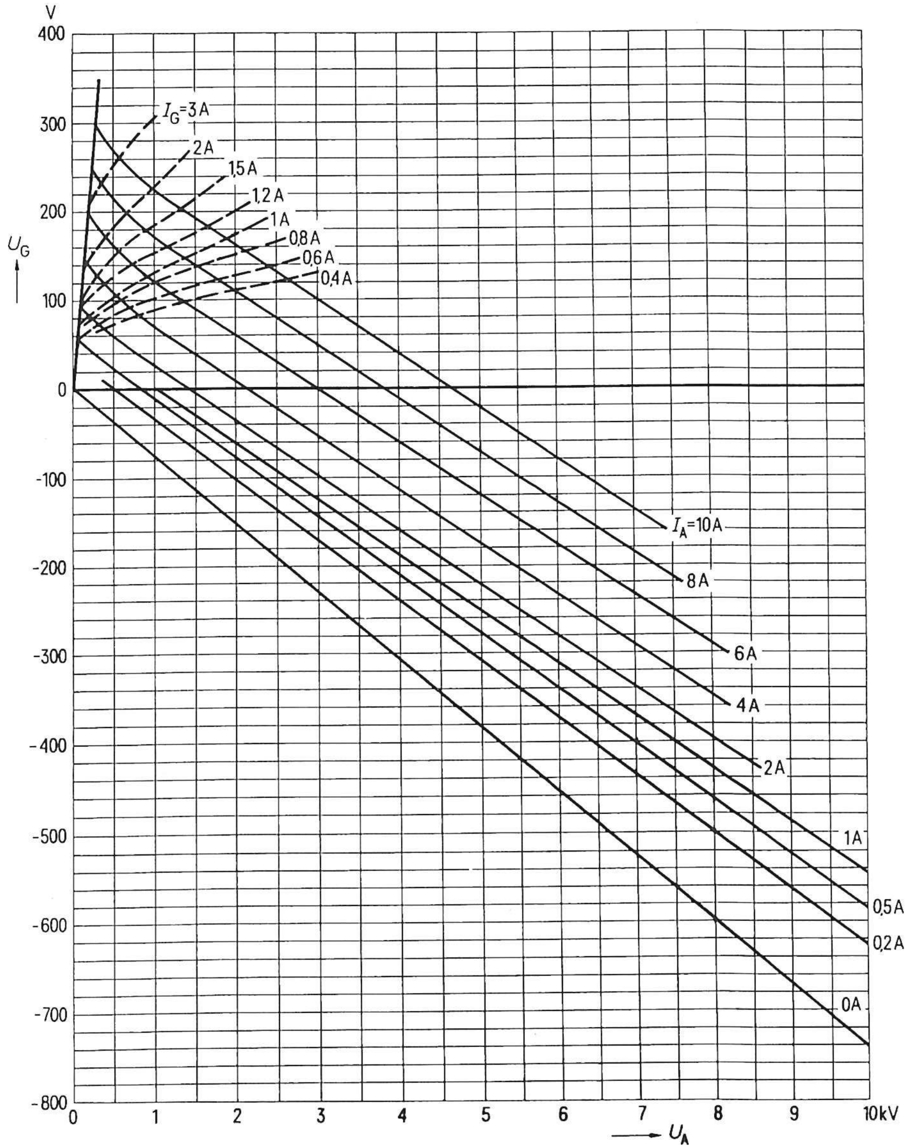
Cooling data for maximum anode dissipation	$P_{A\,max}$ = 10 kW
Total power to be dissipated by the cooling system ($P_A + P_G + 0{,}8\ P_F$)	10,4 kW
Equivalent thermal output	625 kJ/min (149 kcal/min)
Flow rate of returning water	
at returning water temperature of 20 °C	approx. 0,24 l/min
at returning water temperature of 90 °C	approx. 0,27 l/min
Volume of generated vapor	
at returning water temperature of 20 °C	approx. 0,40 m^3/min
at returning water temperature of 90 °C	approx. 0,45 m^3/min

Detailed information on vapor cooling upon request. Please observe instructions on vapor cooling given under "Explanations on Technical Data".

Safety precautions

The section "Safety precautions" under "Explanations on Technical Data" describes how the tube is to be protected against damage due to electric overload or insufficient cooling. A copper wire with 0,20 mm diameter should be used to test the anode overcurrent trip circuit.

$U_G = f(U_A)$ Parameter = I_A ————————
Parameter = I_G – – – – – – – –

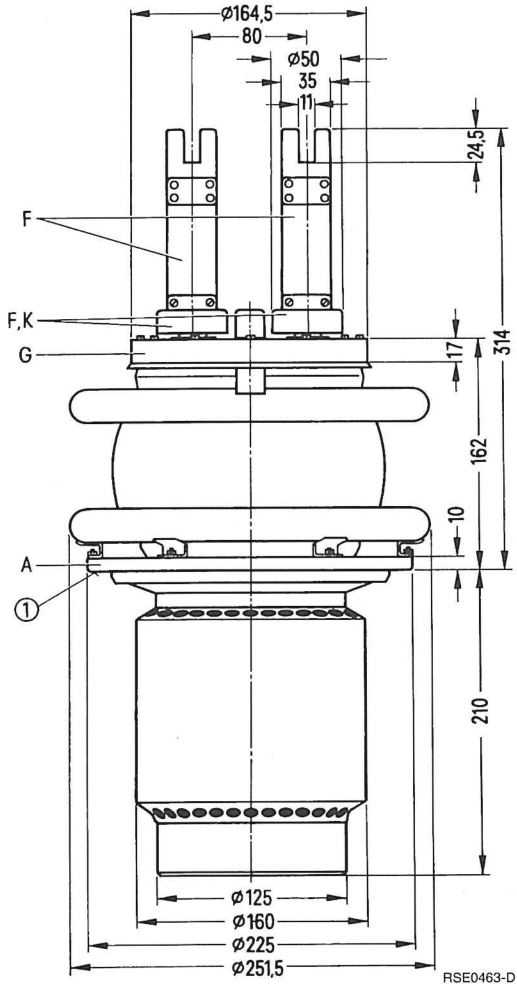


RSE0462-5

VX

Ordering code Q53-X876

Vapor-cooled triode with coaxial grid lead-through, particularly suitable for modulators of 200 kW to 250 kW transmitters.



Dimensions in mm

① Sealing surface

Approx. weight 24 kg

Modulator Triode

RS 876

Heating

Heater voltage	U_F	11	V
Heater current	I_F	≈ 155	A
Permissible starting current	I_{FM}	≤ 300	A
Heating: direct			
Cathode: thoriated tungsten			

Characteristics

Emission current at $U_A = U_G = 500$ V	I_{em}	42	A
Amplification factor at $U_A = 8$ to 10 kV, $I_A = 3$ A	μ	15	
Transconductance at $U_A = 8$ kV, $I_A = 3$ A	S	40	mA/V

Capacitances

Cathode/grid	c_{kg}	≈ 130	pF
Cathode/anode	c_{ka}	≈ 3,8	pF [1]
Grid/anode	c_{ga}	≈ 75	pF

Accessories

Accessories		Ordering code
Mounting instruction	RöMo876	
RF terminal (2 for each tube)	RöKat876	Q1001-X24
Grid terminal for SW	RöGit876	Q1001-X13
Grid terminal for MW	RöGit877	Q1001-X11
Handle	RöZub876	Q1001-X101
Boiler	RöKüV876	Q1001-X42
Insulating pipe at water inlet	RöKüV31Zub4	Q81-X1634
Union at water inlet	RöKüV31Zub7	Q81-X1637
Gasket at vapor outlet	RöKüV201Zub8	Q81-X1678
Insulating pipe at vapor outlet	RöKüV876Zub3	Q81-X1610
Insulator	RöKüV876Zub5K	Q81-X1659
Water level stabilizer with control electrodes	RöZubV4	Q81-X2105
LL electrolytic target	RöEl41	C65055-A667-A41
Gasket ring for boiler		C65051-A411-C552
Gasket ring for water supply line		C65055-A620-C523
Gasket ring for vapor outlet		C65055-A620-C526

1) Measured by means of a 50 cm diameter screening plate in the grid terminal plane.

AF amplifier and modulator, class B operation, 2 tubes in push-pull circuit

Maximum ratings

Anode voltage (dc)	U_A	14	kV
Grid voltage (dc)	U_G	– 2	kV
Cathode current (dc)	I_K	16	A
Peak cathode current	$I_{K\,M}$	50	A
Anode dissipation	P_A	75	kW
Grid dissipation	P_G	700	W

Operating characteristics at modulator operation for

		250 kW carrier power		
Output power	P_2	0	200	kW
Anode voltage (dc)	U_A	11,5	11,5	kV
Grid voltage (dc)	U_G	– 720	– 720	V
Peak control grid voltage (ac) between the 2 tubes	$U_{gg\,m}$	0	2340	V
Anode current (dc)	I_A	2 × 1	2 × 14,5	A
Grid current (dc)	I_G	0	2 × 0,7	A
Anode input power	$P_{B\,A}$	2 × 11,5	2 × 167	kW
Drive power	P_1	0	2 × 820	W
Anode dissipation	P_A	2 × 11,5	2 × 67	kW
Grid dissipation	P_G	0	2 × 310	W
Efficiency	η	–	60	%
Effective load resistance (anode to anode)	R_{AA}	–	820	Ω

Tube mounting

Axis vertical, anode down.

For connection of the tube use the terminals listed under "Accessories". The heater current is applied via flexible strips which are attached to the tube and must not be removed. A possibly necessary RF connection must be established via helix contacts at the caps below the flexible heater strips.

Maximum tube surface temperature

The temperature of the glass-to-metal seals must not exceed 170 °C at any point. The maximum permissible temperature in the center of the glass bulb between grid and anode is 220 °C. At the ceramic cathode lead-throughs the temperature should not exceed 220 °C.

The maximum temperature difference at the bulb circumference is 50 °C, and in axial direction 120 °C. The temperature gradient must not exceed 25 °C/cm. The temperature can be kept within these limits by providing additional air cooling of the tube terminals by an adequately directed air flow of at least 2 m³/min.

Vapor cooling

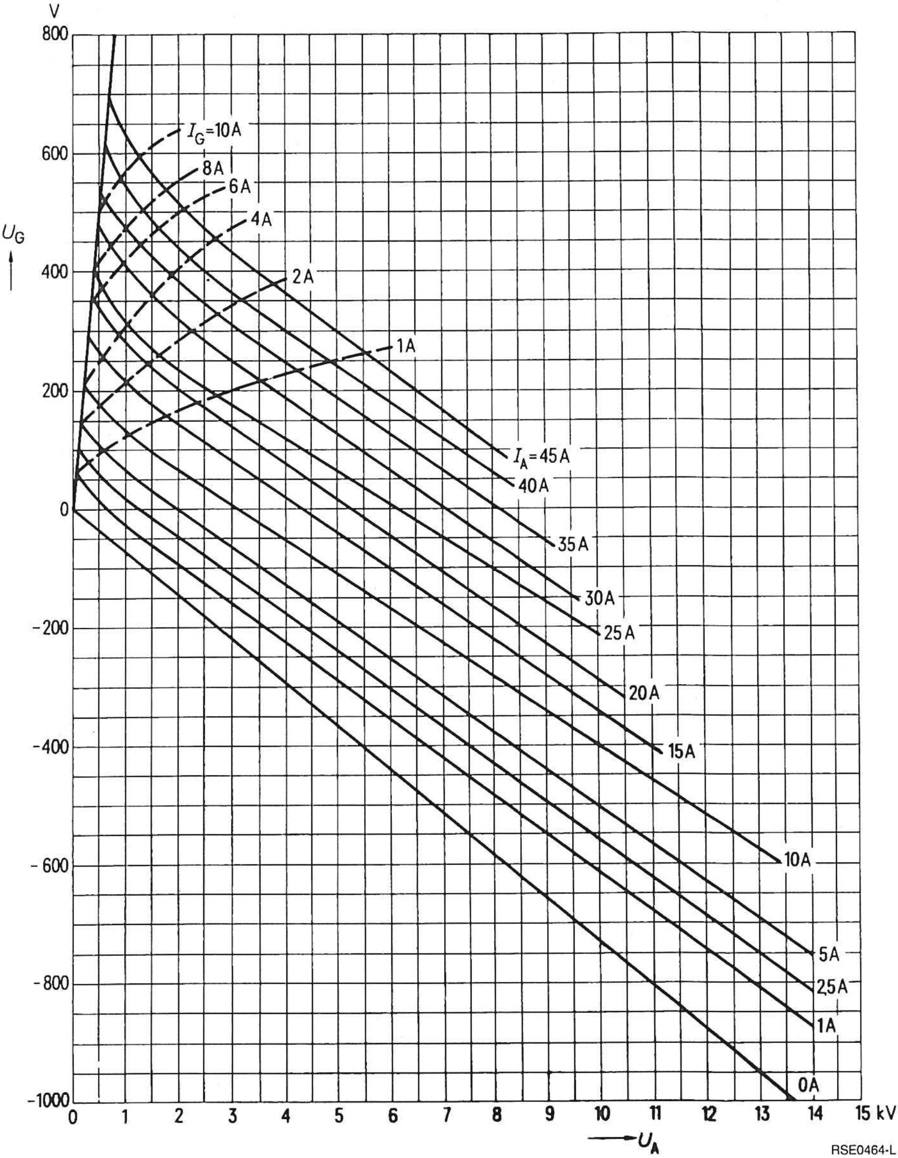
Cooling data for maximum anode dissipation	$P_{A\,max} = 75$ kW
Total power to be dissipated by the cooling system ($P_A + P_G + 0{,}8\ P_F$)	76,1 kW
Equivalent thermal output	4570 kJ/min (1090 kcal/min)
Flow rate of returning water	
at returning water temperature of 20 °C	approx. 1,8 l/min
at returning water temperature of 90 °C	approx. 2,0 l/min
Volume of generated vapor	
at returning water temperature of 20 °C	approx. 3,0 m^3/min
at returning water temperature of 90 °C	approx. 3,3 m^3/min

Detailed information on vapor cooling upon request. Please observe instructions on vapor cooling given under "Explanations on Technical Data".

Safety precautions

The section "Safety precautions" under "Explanations on Technical Data" describes how the tube is to be protected against damage due to electric overload or insufficient cooling. A copper wire with 0,25 mm diameter should be used to test the anode overcurrent trip circuit.

$U_G = f(U_A)$ Parameter = I_A ——————
Parameter = I_G – – – – – – –



For frequencies up to 960 MHz

Coaxial metal-ceramic tetrode with integrated resonance suppression, forced-air-cooled or vapor-condensation-cooled, particularly suitable for TV transmitters, band IV/V.

Forced-air-cooled version

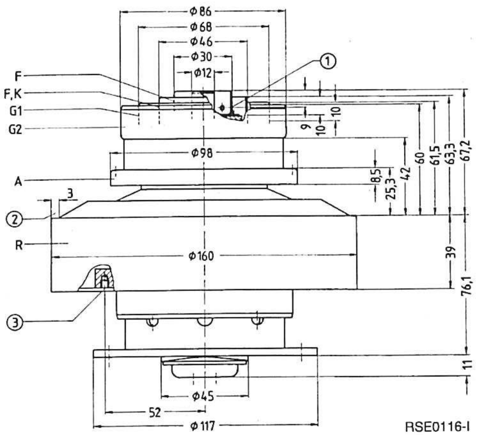
RS 1034 L

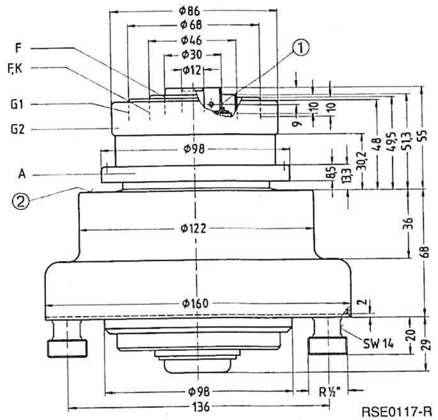
Ordering code Q51-X1034

Vapor-condensation-cooled version

RS 1034 SK

Ordering code Q53-X1034





Dimensions in mm

① 8 tapholes Ø 3 (8 × 45°)
② Tube support in the cavity
③ Taphole M4 for tube fuse RöSich2

Approx. weight 5,3 kg

Approx. 7 kg

The radiator or boiler and the terminals are of concentric design with the following diameters:

Radiator (R)	Ø 161,5	G1 terminal	Ø 69,0
Boiler	Ø 123,5	Heater/cathode terminal	Ø 47,0
Anode terminal	Ø 99,0	Heater terminal	Ø 30,6
G2 terminal	Ø 87,0		

VX

Heating

Heater voltage	U_F	4,5	V
Heater current	I_F	≈ 200	A
Heating: direct			
Cathode: thoriated tungsten			

Characteristics

Emission current at $U_A = U_{G2} = U_{G1} = 300$ V	I_{em}	45	A
Amplification factor of screen grid at $U_A = 2$ kV, $U_{G2} = 500$ to 800 V, $I_A = 3$ A	μ_{g2g1}	7,5	
Transconductance at $U_A = 2$ kV, $U_{G2} = 800$ V, $I_A = 2$ to 4 A	s	120	mA/V

Capacitances

Cathode/control grid	c_{kg1}	≈ 100	pF
Cathode/screen grid	c_{kg2}	≈ 7,80	pF
Cathode/anode	c_{ka}	≈ 0,05	pF [1])
Control grid/screen grid	c_{g1g2}	≈ 184	pF
Control grid/anode	c_{g1a}	≈ 0,55	pF [1])
Screen grid/anode	c_{g2a}	≈ 23,5	pF [2])

Accessories RS 1034 L

			Ordering code
Socket wrench for tube fuse		RöZub10	Q81-X2110
Tube extractor		RöZub134	Q81-X2115
Tube fuse		RöSich2	Q81-X1402
Pull switch for tube fuse		RöKt11	Q81-X1311
Cavity band IV/V,	10 kW vision	TK8305 or	Q94-X8305
		TK8311	Q94-X8311
	5 kW vision/sound	TK8305 or	Q94-X8305
		TK8311	Q94-X8311

RS 1034 SK

Tube extractor		RöZub134SK	Q81-X2116
LL electrolytic target for 1/2″-hose		RöEl5	Q81-X365
Cavity band IV/V,	20 kW vision	TK8306 or	Q94-X8306
		TK8312	Q94-X8312
	10 kW vision/sound	TK8306 or	Q94-X8306
		TK8312	Q94-X8312

1) Measured by a Ø 50 cm screening plate in the screen-grid terminal plane.
2) Measured by a Ø 50 cm screening plate in the anode ceramic plane.

TV vision transmitter, grounded control-grid screen-grid circuit, negative modulation standard G

Maximum ratings

Frequency		f	960	MHz
Anode voltage (dc)	(RS 1034 L)	U_A	5,5	kV
Anode voltage (dc)	(RS 1034 SK)	U_A	7,5	kV
Screen grid voltage (dc)		U_{G2}	1000	V
Control grid voltage (dc)		U_{G1}	– 200	V
Cathode current (dc)		I_K	6,0	A
Peak cathode current		I_{KM}	40	A
Anode dissipation	(RS 1034 L)	P_A	13	kW
Anode dissipation	(RS 1034 SK)	P_A	25	kW
Screen grid dissipation		P_{G2}	180	W
Control grid dissipation		P_{G1}	80	W

Operating characteristics

		1)		
Frequency	f	470 ... 800	470 ... 800	MHz
Bandwidth (1 dB)	B	12	12	MHz
Output power, sync level	$P_{2\,SY}$	24	12,4	kW 2)
Output power, black level	$P_{2\,SW}$	13,6	7,0	kW 2) 3)
Gain	V_p	15,5	16	dB
Anode voltage (dc)	U_A	6,6	5,1	kV
Screen grid voltage (dc)	U_{G2}	800	800	V
Control grid voltage (dc)	U_{G1}	– 110	– 110	V
Peak control grid voltage (ac), sync level	$U_{g1\,m\,SY}$	104	100	V
Zero-signal anode current (dc)	$I_{A\,0}$	2,2 4)	1,6 4)	A
Anode current (dc), black level	$I_{A\,SW}$	5,3 4)	3,6 4)	A
Screen grid current (dc), black level	$I_{G2\,SW}$	140	60	mA
Anode input power, black level	$P_{B\,A\,SW}$	35	18,4	kW
Drive power, sync level	$P_{1\,SY}$	675	310	W
Anode dissipation, black level	$P_{A\,SW}$	21,4	11,4	kW
Screen grid dissipation, black level	$P_{G2\,SW}$	110	48	W
Anode load resistance	R_A	460	450	Ω

1) Only for RS 1034 SK.
2) Without taking circuit losses into account.
3) Black level with gated sync. pulses.
4) Average value ± 0,2 A.

VX

Amplifier for TV transmitters with common vision and sound carrier transmission, grounded control-grid screen-grid circuit, vision-to-sound ratio 10:1, standard G

Maximum ratings

Frequency		f	960	MHz
Anode voltage (dc)	(RS 1034 L)	U_A	5,5	kV
Anode voltage (dc)	(RS 1034 SK)	U_A	7,5	kV
Screen grid voltage (dc)		U_{G2}	1000	V
Control grid voltage (dc)		U_{G1}	– 200	V
Cathode current (dc)		I_K	6,0	A
Peak cathode current		$I_{K\,M}$	40	A
Anode dissipation	(RS 1034 L)	P_A	13	kW
Anode dissipation	(RS 1034 SK)	P_A	25	kW
Screen grid dissipation		P_{G2}	180	W
Control grid dissipation		P_{G1}	80	W

Operating characteristics

		[1]		
Frequency	f	470 ... 800	470 ... 800	MHz
Output power, sync level	$P_{2\,SY}$	12,6/1,26	6,3/0,63	kW [2]
Gain	V_p	15,5	16	dB
3-tone intermodulation ratio	a_{IM3}	≥ 50	≥ 52	dB
Anode voltage (dc)	U_A	6,3	5,1	kV
Screen grid voltage (dc)	U_{G2}	800	800	V
Control grid voltage (dc)	U_{G1}	– 112	– 108	V
Peak control grid voltage (ac), sync level	$U_{g1\,m\,SY}$	100	70	V
Zero-signal anode current (dc)	$I_{A\,0}$	1,8	1,8	A [3]
Anode current (dc), black level	$I_{A\,SW}$	3,9	2,8	A
Screen grid current (dc), black level	$I_{G2\,SW}$	90	50	mA
Anode input power, black level	$P_{B\,A\,SW}$	24,6	14,3	kW
Drive power, sync level	$P_{1\,SY}$	360	160	W
Drive power, sound	$P_{1\,Ton}$	36	16	W
Anode dissipation, black level	$P_{A\,SW}$	16,2	10,1	kW
Anode load resistance	R_A	440	520	Ω

1) Only for RS 1034 SK.
2) Without taking circuit losses into account.
3) Average value ± 0,2 A.

Tube mounting

Axis vertical, anode up or down.

Spring contact rings are suitable connectors for cathode, control grid, screen grid and anode. The spring tension must be dimensioned such that the required power for inserting and withdrawing the tube remains below 150 N. Recommended pull-off power per spring contact ring is approx. 20 N. For further details see "Explanations on Technical Data".

Maximum tube surface temperature

The temperature of the electrode terminals and ceramic insulators must not exceed 220 °C. For keeping below this maximum temperature an air flow is required to cool the terminal rings. For this purpose the terminal contacts must be designed for providing a uniform cooling effect.

Forced-air cooling (RS 1034 L)

The minimum air flow rate required for maximum anode dissipation is given in the cooling air diagram, valid for 25 °C inlet temperature at 1 bar air pressure (sea level). The cooling air must be supplied from the electrode terminal side. For detailed information on forced-air cooling refer to "Explanations on Technical Data".

Vapor condensation cooling (RS 1034 SK)

The cooling water diagram gives the minimum water flow rate (distilled or deionized water) for maximum anode dissipation, as well as pressure drop and water outlet temperature at 70 °C water inlet temperature. The diagram applies to a hermetically sealed cooling system with 1,5 bar overpressure at the tube's cooling water outlet and with a maximum permissible water outlet temperature of 100 °C.

Operation with open cooling cycle (without overpressure) is also possible if the maximum outlet temperature remains below 70 °C (sea level, air pressure ≈ 1 bar) with lower inlet temperature and, if required, increased water flow rate.

For more information on vapor condensation cooling refer to "Explanations on Technical Data".

Automatic heating power regulation

Recommendations for automatic heating power stabilization are contained in the instruction "UHF TV Tetrodes, Heating Power Adjustment", which is supplied upon request.

Safety precautions

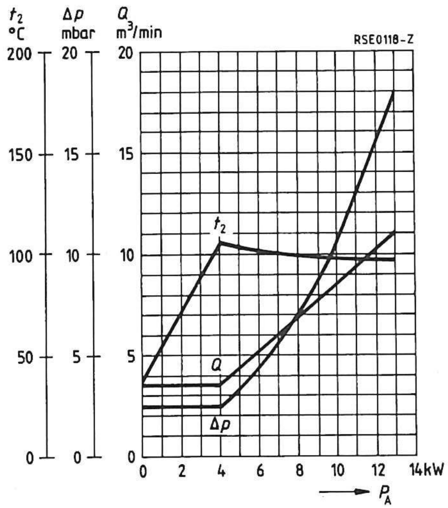
The section "Safety precautions" under "Explanations on Technical Data" describes how the tube is to be protected against damage due to electric overload or insufficient cooling. A copper wire with Ø 0,12 mm should be used to test the anode overcurrent trip circuit.

For protecting RS 1034 L against thermal anode overload the tube fuse RöSich2 is recommended. In conjunction with pull switch RöKt11 it disconnects the voltages at the tube in case of overload (accessories).

Transmitter off-periods

Frequent switching of the heating reduces lifetime. So the heating (and cooling) should be left on during transmitter off-periods of up to two hours. Continuous heating with reduced power (black heating) should be provided for longer off-periods. Refer to “Explanations on Technical Data”.

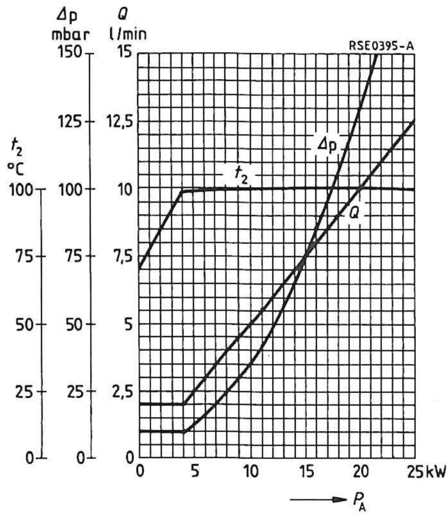
Cooling air diagram (RS 1034 L)



The cooling air is supplied from the electrode terminal side.

Air pressure = 1 bar
t_1 = 25 °C

Cooling water diagram (RS 1034 SK)

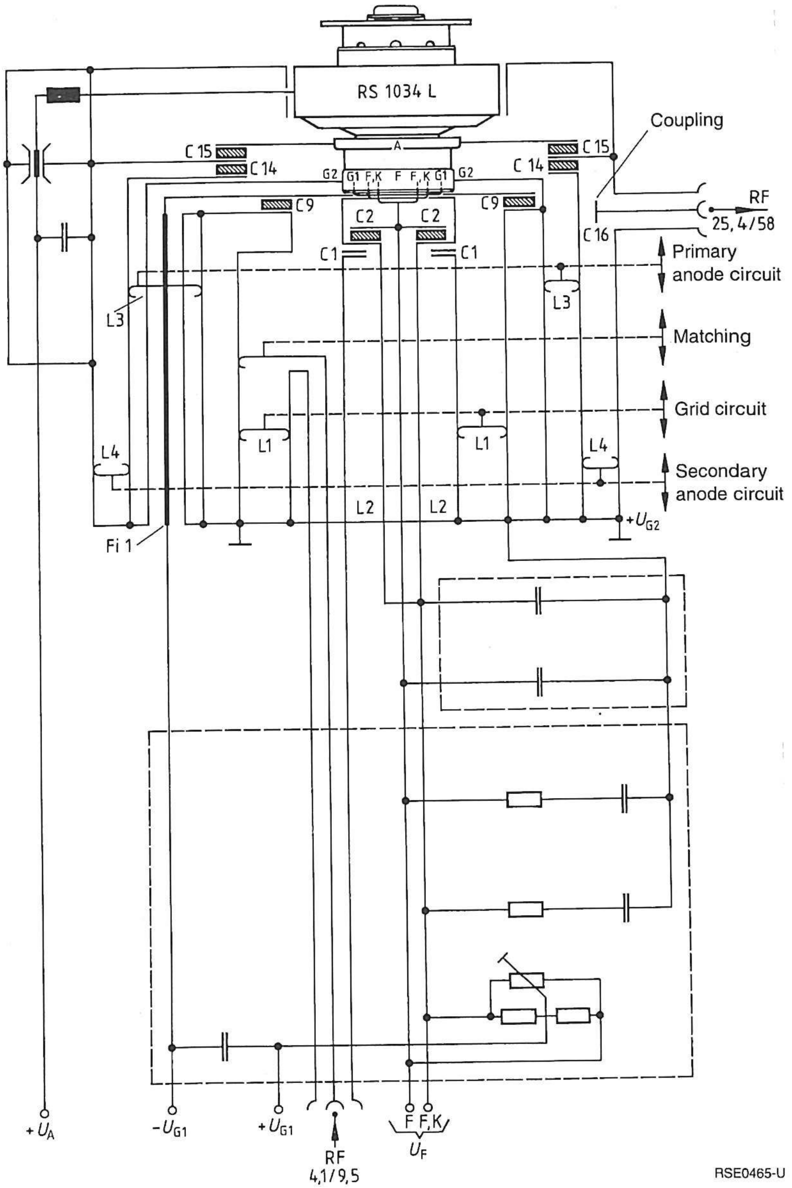


Closed cooling cycle with distilled water.

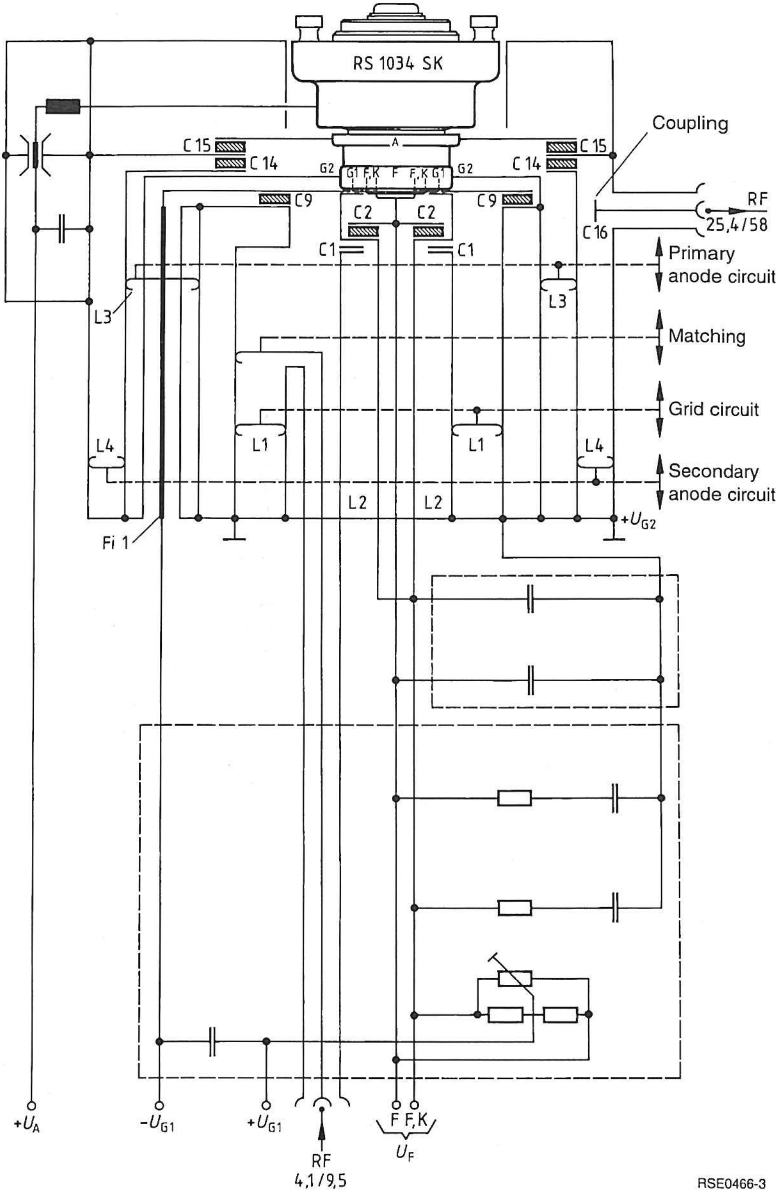
Overpressure = 1,5 bar
t_1 = 70 °C

VX

Basic circuit diagram of final-stage cavity

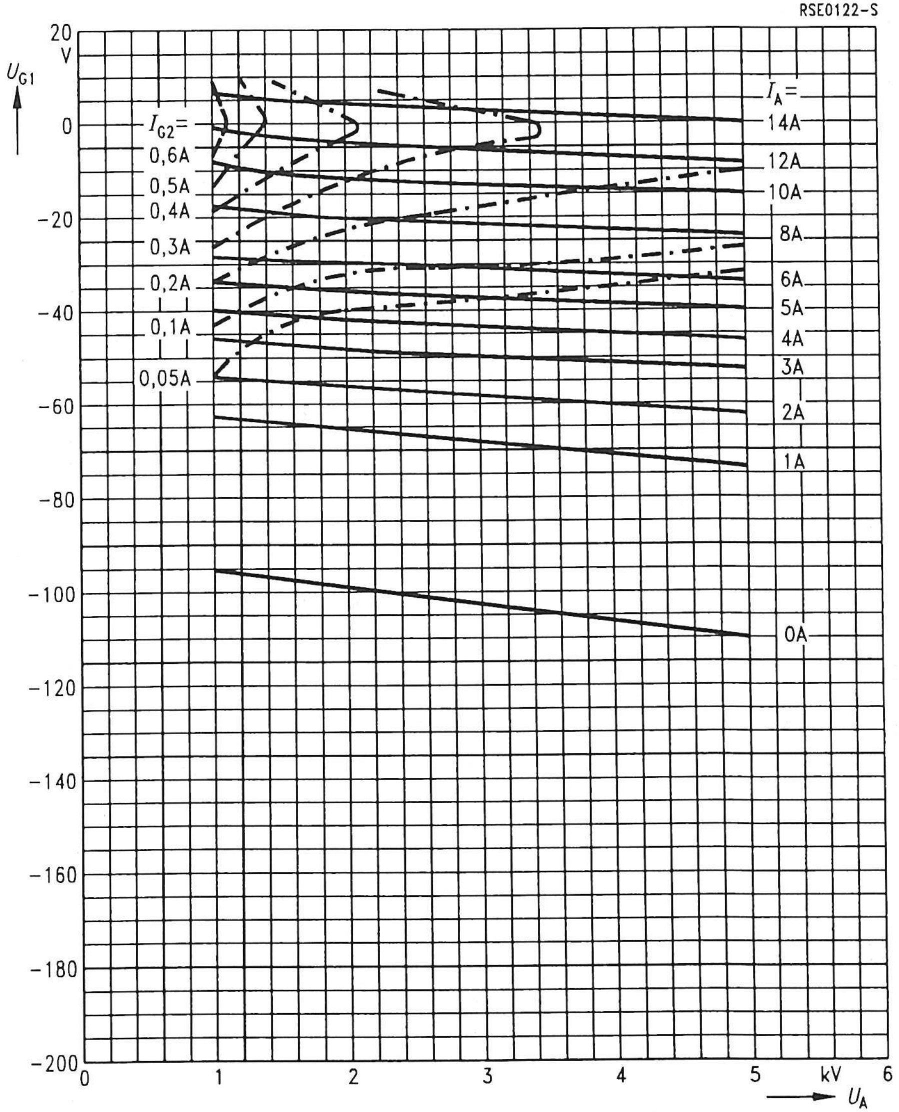


Basic circuit diagram of final-stage cavity



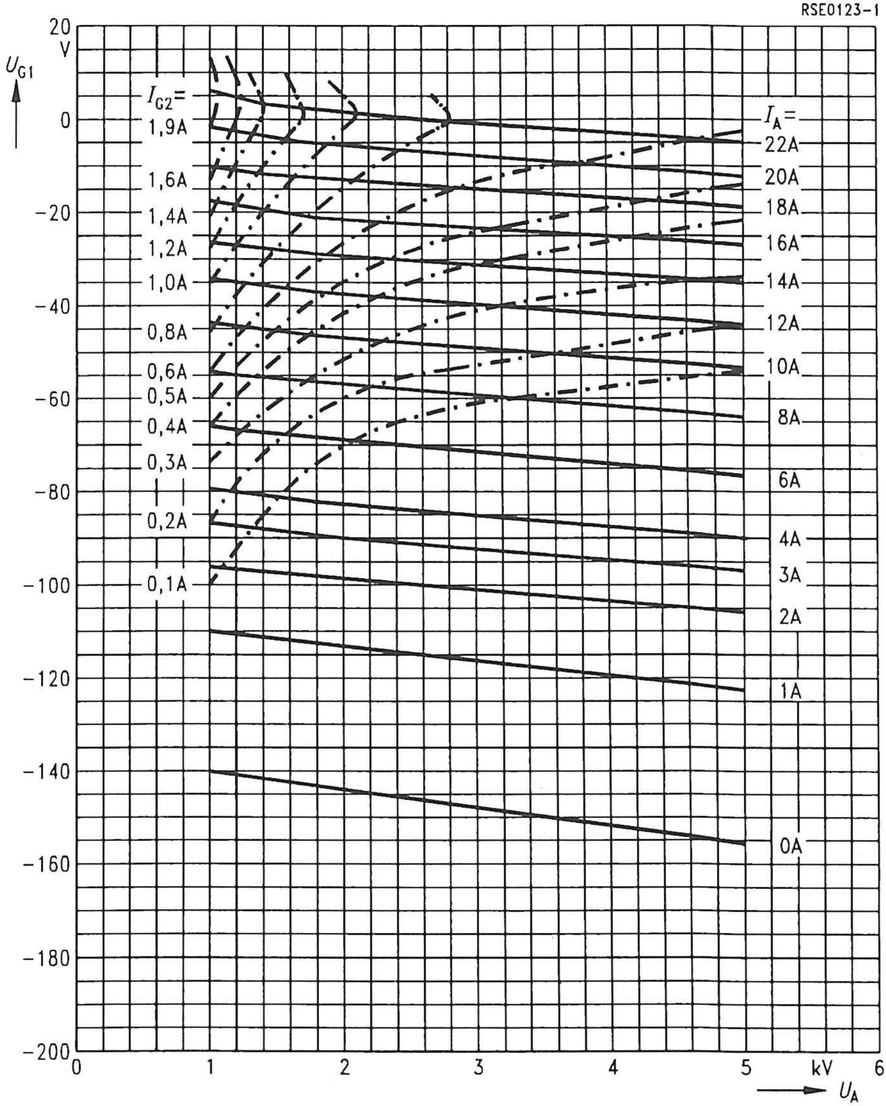
$U_{G1} = f(U_A)$ Parameter = I_A ————————

$U_{G2} = 500$ V Parameter = I_{G2} —·—·—·—·—·—



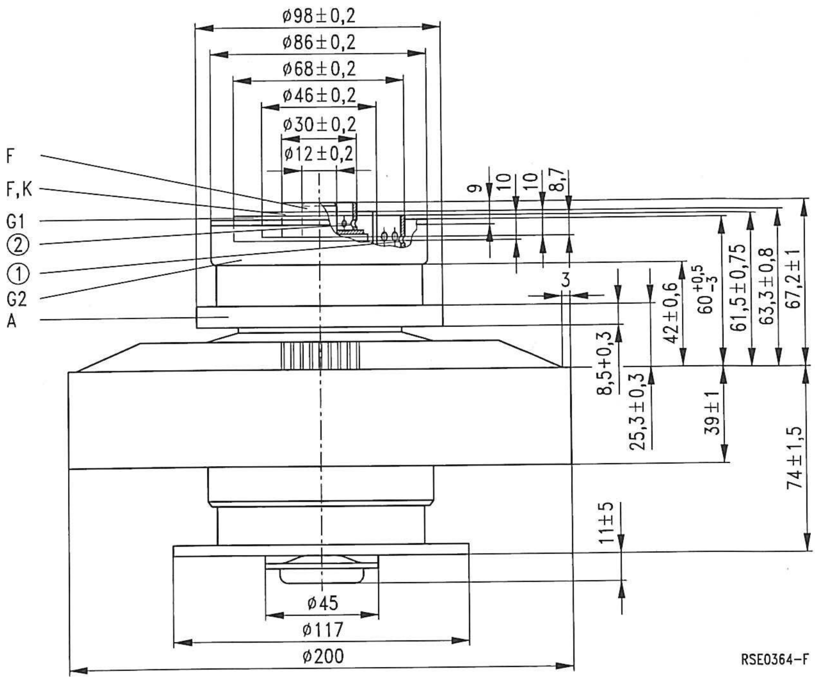
VX

$U_{G1} = f(U_A)$ Parameter = I_A ———
$U_{G2} = 800$ V Parameter = I_{G2} —·—·—



Ordering code Q51-X1036

Coaxial metal-ceramic tetrode with integrated resonance suppression for TV transmitters, band IV/V.



Dimensions in mm

① 18 tapholes Ø 3
② 8 tapholes Ø 3

Approx. weight 7,8 kg

VX

Heating

Heater voltage	U_F	4,5	V
Heater current	I_F	≈ 200	A
Heating: direct			
Cathode: thoriated tungsten			

Characteristics

Emission current at $U_A = U_{G2} = U_{G1} = 300$ V	I_{em}	45	A
Amplification factor of screen grid at $U_A = 2$ kV, $U_{G2} = 500$ to 800 V, $I_A = 3$ A	μ_{g2g1}	7,5	
Transconductance at $U_A = 2$ kV, $U_{G2} = 800$ V, $I_A = 2$ to 4 A	s	120	mA/V

Capacitances

Cathode/control grid	c_{kg1}	≈ 100	pF
Cathode/screen grid	c_{kg2}	≈ 7,50	pF
Cathode/anode	c_{ka}	≈ 0,05	pF [1])
Control grid/screen grid	c_{g1g2}	≈ 195	pF
Control grid/anode	c_{g1a}	≈ 0,55	pF [1])
Screen grid/anode	c_{g2a}	≈ 20,0	pF

1) Measured by a Ø 50 cm screening plate in the screen-grid terminal plane.

Amplifier for TV transmitters with common vision and sound carrier transmission, grounded control-grid screen-grid circuit, vision-to-sound ratio 10:1, standard G

Maximum ratings

Frequency	f	960	MHz
Anode voltage (dc)	U_A	7,0	kV
Screen grid voltage (dc)	U_{G2}	1000	V
Control grid voltage (dc)	U_{G1}	– 200	V
Cathode current (dc)	I_K	6,0	A
Peak cathode current	$I_{K\,M}$	30	A
Anode dissipation	P_A	20	kW
Screen grid dissipation	P_{G2}	180	W
Control grid dissipation	P_{G1}	80	W

Operating characteristics

Frequency	f	470 ... 800	MHz
Bandwidth	B	11	MHz
Output power, sync level	$P_{2\,SY}$	11,5/1,15	kW [1])
Gain	V_p	15	dB
3-tone intermodulation ratio	a_{IM3}	> 50	dB
Anode voltage (dc)	U_A	6,0	kV
Screen grid voltage (dc)	U_{G2}	800	V
Control grid voltage (dc)	U_{G1}	– 112	V
Peak control grid voltage (ac), sync level	$U_{g1\,m\,SY}$	100	V
Zero-signal anode current (dc)	$I_{A\,0}$	1,8	A
Anode current (dc), black level	$I_{A\,SW}$	3,7	A
Screen grid current (dc), black level	$I_{G2\,SW}$	90	mA
Anode input power, black level	$P_{B\,A\,SW}$	22,2	kW
Drive power, sync level	$P_{1\,SY}$	360	W
Drive power, sound	$P_{1\,Ton}$	36	W
Anode dissipation, black level	$P_{A\,SW}$	14,6	kW
Anode load resistance	R_A	440	Ω

1) Without taking circuit losses into account.

TV vision transmitter,
grounded control-grid screen-grid circuit, negative modulation, standard G

Maximum ratings

Frequency	f	960	MHz
Anode voltage (dc)	U_A	7,0	kV
Screen grid voltage (dc)	U_{G2}	1000	V
Control grid voltage (dc)	U_{G1}	– 200	V
Cathode current (dc)	I_K	6,0	A
Peak cathode current	$I_{K\,M}$	30	A
Anode dissipation	P_A	20	kW
Screen grid dissipation	P_{G2}	180	W
Control grid dissipation	P_{G1}	80	W

Operating characteristics

Frequency	f	470 ... 800	MHz
Bandwidth (1 dB)	B	11	MHz
Output power, sync level	$P_{2\,SY}$	23	kW [1]
Output power, black level	$P_{2\,SW}$	13	kW
Gain	V_p	15,5	dB
Anode voltage (dc)	U_A	6,4	kV
Screen grid voltage (dc)	U_{G2}	800	V
Control grid voltage (dc)	U_{G1}	– 112	V
Peak control grid voltage (ac), sync level	$U_{g1\,m\,SY}$	104	V
Zero-signal anode current (dc)	$I_{A\,0}$	2,2	A
Anode current (dc), black level	$I_{A\,SW}$	5,0	A
Screen grid current (dc), black level	$I_{G2\,SW}$	140	mA
Anode input power, black level	$P_{B\,A\,SW}$	32	kW
Drive power, sync level	$P_{1\,SY}$	650	W
Anode dissipation, black level	$P_{A\,SW}$	19	kW
Anode load resistance	R_A	480	Ω

1) Without taking circuit losses into account.

Tube mounting

Axis vertical, anode up or down.

Spring contact rings are suitable connectors for cathode, control grid, screen grid and anode. The spring tension must be dimensioned such that the required power for inserting and withdrawing the tube remains below 150 N. Recommended pull-off power per spring contact ring is approx. 20 N. For further details see "Explanations on Technical Data".

Maximum tube surface temperature

The temperature of the electrode terminals and ceramic insulators must not exceed 220 °C. For keeping below this maximum temperature an air flow is required to cool the terminal rings. For this purpose the terminal contacts must be designed for providing a uniform cooling effect.

Forced-air cooling

The minimum air flow rate required for maximum anode dissipation is given in the cooling air diagram, valid for 25 °C inlet temperature at 1 bar air pressure (sea level). The cooling air must be supplied from the electrode terminal side. For detailed information on forced-air cooling refer to "Explanations on Technical Data".

Automatic heating power regulation

Recommendations for automatic heating power stabilization are contained in the instruction "UHF TV Tetrodes, Heating Power Adjustment", which is supplied upon request.

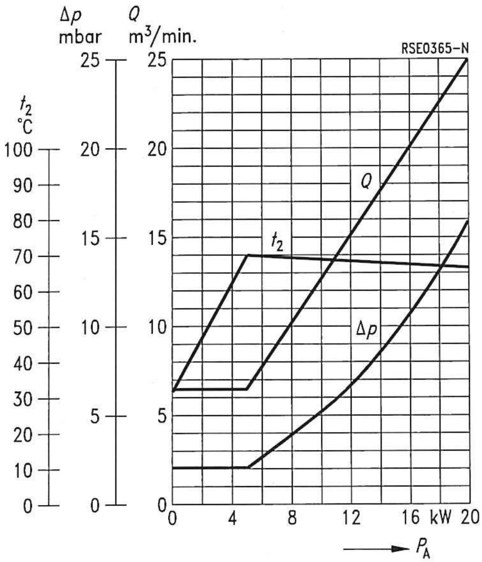
Safety precautions

The section "Safety precautions" under "Explanations on Technical Data" describes how the tube is to be protected against damage due to electric overload or insufficient cooling. A copper wire with Ø 0,12 mm should be used to test the anode overcurrent trip circuit.

Transmitter off-periods

Frequent switching of the heating reduces lifetime. So the heating (and cooling) should be left on during transmitter off-periods of up to two hours. Continuous heating with reduced power (black heating) should be provided for longer off-periods. Refer to "Explanations on Technical Data".

Cooling air diagram



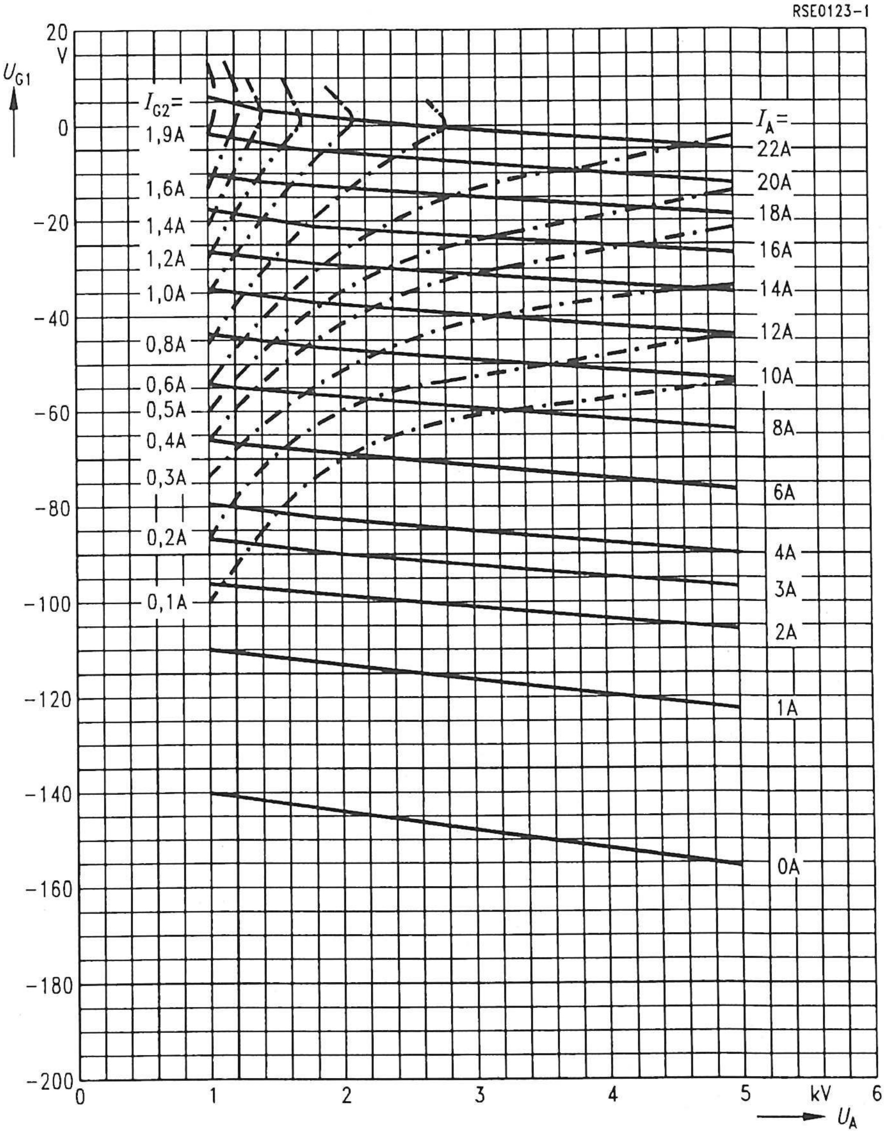
The cooling air is supplied from the electrode terminal side.

Air pressure = 1 bar

t_1 = 25 °C

$U_{G1} = f\,(U_A)$ Parameter = I_A ————————

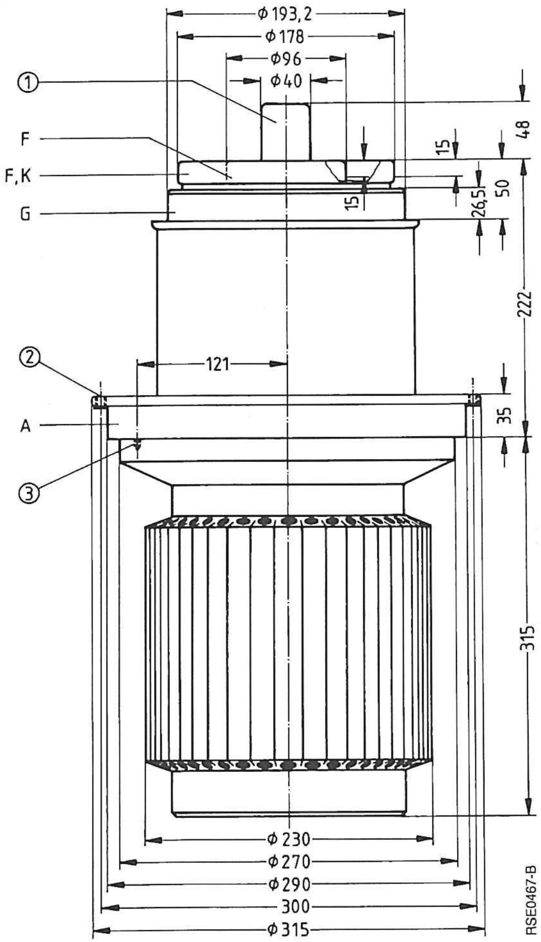
$U_{G2} = 800$ V Parameter = I_{G2} —·—·—·—·—·—



VX

Ordering code Q53-X1043

Coaxial metal-ceramic triode, vapor-cooled, particularly suitable for broadcast transmitters of up to 200 kW medium and short wave.



Dimensions in mm

① Do not use as terminal
② Taphole M8 for screw-in handle RöZub41V
③ Taphole M5 for tube fuse RöSich4

Approx. weight 52 kg

Heating

Heater voltage	U_F	18	V
Heater current	I_F	≈ 260	A
Heating: direct			
Cathode: thoriated tungsten			

Characteristics

Emission current at $U_A = U_G = 750$ V	I_{em}	190	A
Amplification factor at $U_A = 4$ to 10 kV, $I_A = 5$ A	μ	55	
Transconductance at $U_A = 4$ kV, $I_A = 5$ A	s	135	mA/V

Capacitances

Cathode/grid	c_{kg}	≈ 270	pF
Cathode/anode	c_{ka}	≈ 3,8	pF [1])
Grid/anode	c_{ga}	≈ 115	pF

Accessories		Ordering code
Mounting instruction	RöMo14	
Mounting instruction	RöMo15	
Cathode terminal	RöKat202	C65055-A805-A61
Cathode connecting strip (4 for each tube)	RöKat221	Q81-X1136
Grid terminal	RöGit202b	Q81-X953
Socket wrench for tube fuse	RöZub10	Q81-X2110
Handle	RöZub41V	Q81-X2141
Tube fuse	RöSich4	Q81-X1404
Pull switch for tube fuse	RöKt11	Q81-X1311
Boiler	RöKüV41	Q81-X1641
Insulating pipe at vapor outlet	RöKüV41Zub3	Q81-X1643
Insulating pipe at water inlet	RöKüV41Zub4	Q81-X1644
Insulator	RöKüV41Zub5K	Q81-X1646
Union at water inlet	RöKüV41Zub7	Q81-X1647
Gasket at vapor outlet	RöKüV41Zub8	Q81-X1648
Water level stabilizer with control electrodes	RöZubV4	Q81-X2105
LL electrolytic target	RöEl23	C65055-A667-A23
Gasket ring for boiler	RöN9374	C65051-A202-C553

1) Measured by means of a 40 cm × 40 cm screening plate in the grid terminal plane.

VX

Anode voltage modulation, grounded cathode circuit

Maximum ratings

Frequency	f	30	MHz
Anode voltage (dc)	U_A	13	kV
Grid voltage (dc)	U_G	– 1200	V
Cathode current (dc)	I_K	30	A
Peak cathode current	$I_{K\,M}$	190	A
Anode dissipation	P_A	180	kW
Grid dissipation	P_G	4,0	kW

Operating characteristics

Frequency	f	≤ 30	≤ 30	≤ 30	MHz
Carrier power	P_{trg}	212	165	110	kW 1)
Anode voltage (dc)	U_A	12,5	11	8,0	kV
Grid bias (dc), fixed	$U_{G\,fix}$	– 250	– 170	– 100	V
Grid resistance	R_G	40	40	33	Ω
Peak grid voltage (ac)	$U_{g\,m}$	870	1000	855	V
Anode current (dc)	I_A	21	19	18	A
Grid current (dc)	I_G	5,5	7,4	7,6	A
Anode input power	$P_{B\,A}$	262	209	144	kW
Drive power	P_1	4,4	7,1	6,0	kW 1)
Anode dissipation	P_A	50	44	34	kW 2)
Grid dissipation	P_G	1,8	3,6	3,4	kW
Efficiency	η	81	79	76,5	%
Anode load resistance	R_A	300	365	290	Ω
Modulation factor	m	100	100	100	%
Modulation power	P_{mod}	131	105	72	kW
Grid current (dc)	I_G	7,0	9,5	9,6	A 3)
Drive power	P_1	5,4	8,8	7,3	kW 1) 3)
Grid current (dc)	I_G	4,3	5,8	5,9	A 4)
Drive power	P_1	3,3	5,3	4,6	kW 1) 4)
Anode dissipation during modulation	$P_{A\,mod}$	75	66	51	kW

1) Circuit losses are not included.
2) Even during modulation the indicated maximum ratings must not be exceeded. It has to be observed that during 100 % modulation the plate dissipation increases to about 1,5 times the power dissipation stated for the carrier value.
3) Maximum values at $U_A = 0$ V.
4) Maximum values at peak modulation.

VX

AF amplifier and modulator, class B operation, 2 tubes in push-pull circuit

Maximum ratings

Anode voltage (dc)	U_A	13	kV
Grid voltage (dc)	U_G	– 1200	V
Cathode current (dc)	I_K	35	A
Peak cathode current	$I_{K\,M}$	190	A
Anode dissipation	P_A	180	kW
Grid dissipation	P_G	4,0	kW

Operating characteristics

Output power	P_2	0	450	0	400	kW
Anode voltage (dc)	U_A	12	12	10	10	kV
Grid voltage (dc)	U_G	– 180	– 180	– 150	– 150	V
Peak control grid voltage (ac) between the 2 tubes	$U_{gg\,m}$	0	1210	0	1205	V
Anode current (dc)	I_A	2 × 2	2 × 26	2 × 1,8	2 × 28	A
Grid current (dc)	I_G	0	2 × 4,4	0	2 × 4,8	A
Peak grid current	$I_{G\,M}$	0	2 × 23	0	2 × 24	A
Anode input power	$P_{B\,A}$	2 × 24	2 × 312	2 × 18	2 × 280	kW
Drive power	P_1	0	2 × 2,4	0	2 × 2,6	kW
Anode dissipation	P_A	2 × 24	2 × 87	2 × 18	2 × 80	kW
Grid dissipation	P_G	0	2 × 1,6	0	2 × 1,9	kW
Efficiency	η	–	72	–	71,4	%
Effective load resistance (anode to anode)	R_{AA}	–	552	–	410	Ω

VX

Tube mounting

Axis vertical, anode down.

For connection of the tube use the terminals listed under "Accessories".

Maximum tube surface temperature

The temperature of the tube's ceramic and metal parts must not exceed 220 °C at any point. Therefore, a sufficient air flow has to be provided to cool the terminal side.

Vapor cooling

Cooling data for maximum anode dissipation	$P_{A\,max}$ = 180 kW
Total power to be dissipated by the cooling system ($P_A + P_G + 0{,}8\ P_F$)	188 kW
Equivalent thermal output	11300 kJ/min (2700 kcal/min)
Flow rate of returning water	
at returning water temperature of 20 °C	approx. 4,4 l/min
at returning water temperature of 90 °C	approx. 5,1 l/min
Volume of generated vapor	
at returning water temperature of 20 °C	approx. 7,3 m^3/min
at returning water temperature of 90 °C	approx. 8,3 m^3/min

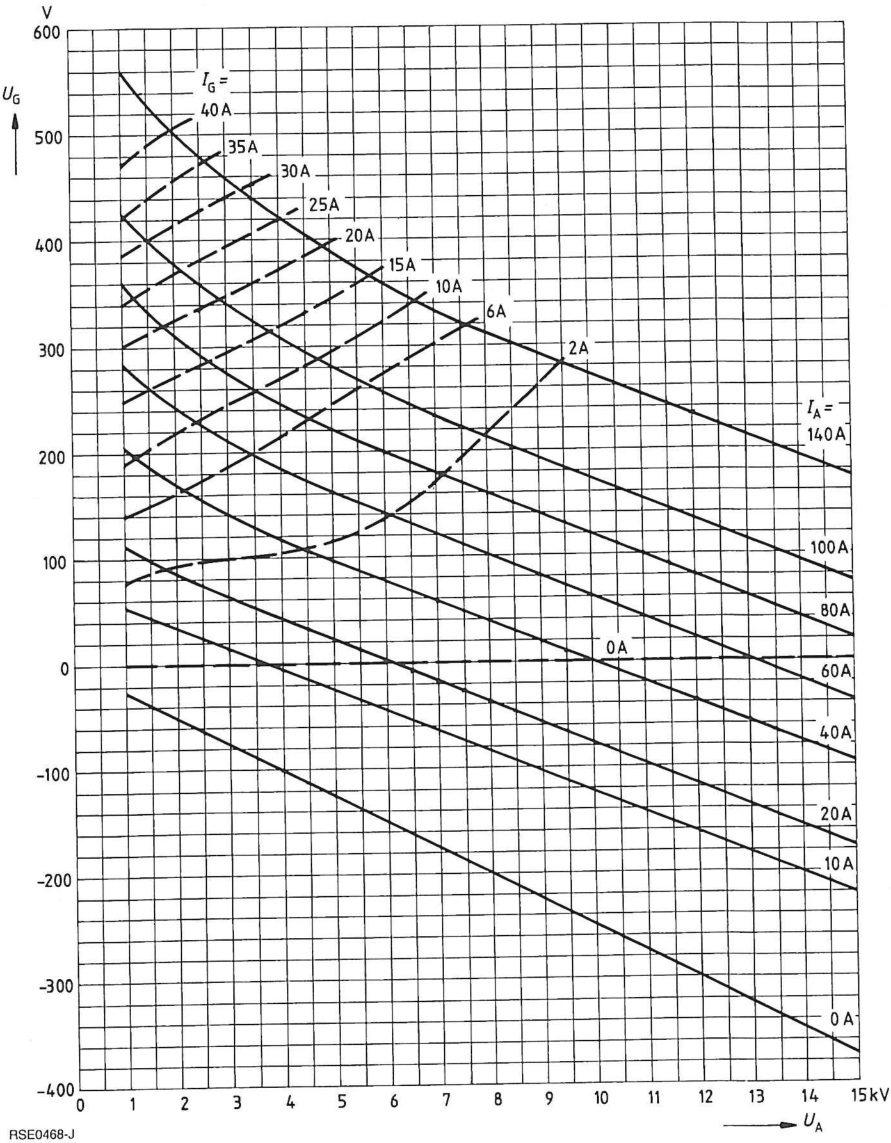
Detailed information on vapor cooling upon request. Please observe instructions on vapor cooling given under "Explanations on Technical Data".

Safety precautions

The section "Safety precautions" under "Explanations on Technical Data" describes how the tube is to be protected against damage due to electric overload or insufficient cooling. A copper wire with 0,26 mm diameter should be used to test the anode overcurrent trip circuit.

For protection against thermal anode overload the tube fuse RöSich4 is recommended. In conjunction with pull switch RöKt11 it disconnects the voltages at the tube in case of overload (see accessories).

$U_G = f(U_A)$ Parameter = I_A ———
Parameter = I_G – – – –

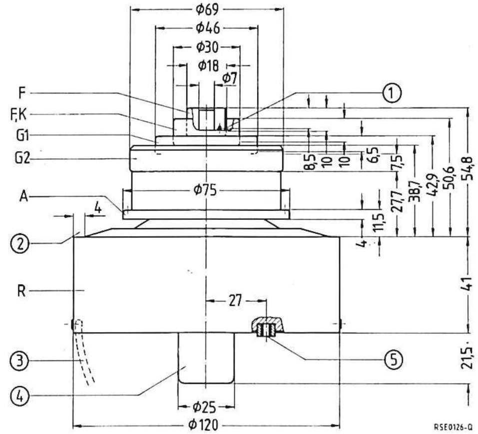


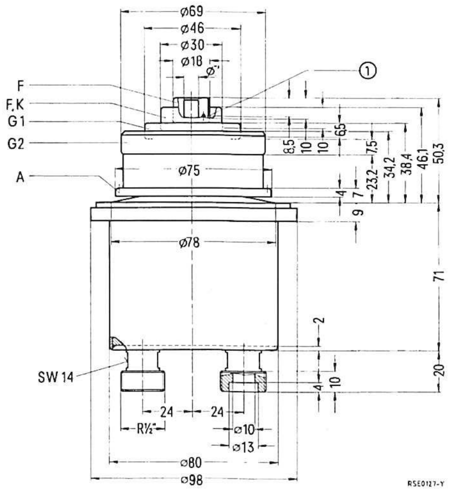
RSE0468-J

For frequencies up to 1000 MHz

Coaxial metal-ceramic tetrode, forced-air-cooled or vapor-condensation-cooled. The tube is especially suitable for TV transmitters, band IV/V.

Forced-air-cooled version	Vapor-condensation-cooled version
RS 1054 L	**RS 1054 SK**
Ordering code Q51-X1054	Ordering code Q53-X1054





① 6 tapholes Ø 3 (6 × 60°)
② Free for anode support
③ Handle, swingable
④ Do not use as terminal
⑤ Taphole M4 for tube fuse RöSich2

Forced-air-cooled version	Vapor-condensation-cooled version
Approx. weight 1,9 kg	Approx. 1,9 kg

The radiator and the terminals are of concentric design with the following diameters:

Radiator	Ø 121,5	G1 terminal	Ø 46,6
Anode terminal	Ø 76,0	Heater/cathode terminal	Ø 30,6
G2 terminal	Ø 69,8	Heater terminal	Ø 18,4

Heating

Heater voltage	U_F	2,8	V
Heater current	I_F	≈ 135	A
Heating: direct			
Cathode: thoriated tungsten			

Characteristics

Emission current at $U_A = U_{G2} = U_{G1} = 200$ V	I_{em}	25	A
Amplification factor of screen grid at $U_A = 2$ kV, $U_{G2} = 500$ to 800 V, $I_A = 1$ A	μ_{g2g1}	9,0	
Transconductance at $U_A = 2$ kV, $U_{G2} = 500$ V, $I_A = 0{,}8$ to 1,2 A	S	60	mA/V

Capacitances

Cathode/control grid	c_{kg1}	≈ 57	pF
Cathode/screen grid	c_{kg2}	≈ 3,8	pF
Cathode/anode	c_{ka}	≈ 0,02	pF 1)
Control grid/screen grid	c_{g1g2}	≈ 112	pF
Control grid/anode	c_{g1a}	≈ 0,25	pF 1)
Screen grid/anode	c_{g2a}	≈ 14	pF 2)

Accessories RS 1054 L

			Ordering code
Socket wrench for tube fuse		RöZub10	Q81-X2110
Tube fuse		RöSich2	Q81-X1402
Pull switch for tube fuse		RöKt11	Q81-X1311
Cavity band IV/V,	3,5 kW vision	TK9201	Q94-X4492
	2,0 kW vision/sound	TK9201	Q94-X4492
Cavity band III,	3,5 kW vision	TK9601	Q94-X4495
	2,0 kW vision/sound	TK9601	Q94-X4495

RS 1054 SK

Tube extractor		RöZub154SK	Q81-X2118
LL electrolytic target for 1/2″-hose		RöEl5	Q81-X365
Cavity band IV/V,	3,5 kW vision	TK9243 or	Q94-X9243
		TK9246	Q94-X9246
	2,0 kW vision/sound	TK9243 or	Q94-X9243
		TK9246	Q94-X9246
	2,0 kW sound	TK9253 or	Q94-X9253
		TK9256	Q94-X9256

1) Measured by a screening plate 30 cm × 30 cm in the screen-grid terminal plane.
2) Measured by a Ø 50 cm screening plate in the anode ceramic plane.

TV vision transmitter,
grounded control-grid screen-grid circuit, negative modulation, standard G

Maximum ratings

Frequency	f	1000	MHz
Anode voltage (dc)	U_A	5,0	kV
Screen grid voltage (dc)	U_{G2}	900	V
Control grid voltage (dc)	U_{G1}	– 150	V
Cathode current (dc)	I_K	3,0	A
Peak cathode current	$I_{K\,M}$	15	A
Anode dissipation	P_A	5,0	kW
Screen grid dissipation	P_{G2}	80	W
Control grid dissipation	P_{G1}	30	W

Operating characteristics

Frequency	f	170 ... 230	470 ... 860	MHz
Bandwidth (1 dB)	B	9,0	9,0	MHz
Output power, sync level	$P_{2\,SY}$	4,6	4,6	kW [1]
Output power, black level	$P_{2\,SW}$	2,5	2,5	kW [1] [2]
Gain	V_p	≥ 16	≥ 16	dB
Anode voltage (dc)	U_A	4,8	4,8	kV
Screen grid voltage (dc)	U_{G2}	800	800	V
Control grid voltage (dc)	U_{G1}	– 77	– 77	V
Peak control grid voltage (ac), sync level	$U_{g1\,m\,SY}$	75	75	V
Zero-signal anode current (dc)	$I_{A\,0}$	0,8	0,8	A
Anode current (dc), black level	$I_{A\,SW}$	1,52	1,52	A
Screen grid current (dc), black level	$I_{G2\,SW}$	45	45	mA
Anode input power, black level	$P_{B\,A\,SW}$	7,3	7,3	kW
Drive power, sync level	$P_{1\,SY}$	100	100	W
Anode dissipation, black level	$P_{A\,SW}$	4,8	4,8	kW
Screen grid dissipation, black level	$P_{G2\,SW}$	36	36	W
Anode load resistance	R_A	1,5	1,5	kΩ

1) Without taking circuit losses into account.
2) Black level with gated sync. pulses.

TV sound transmitter,
class B operation, grounded control-grid screen-grid circuit, standard G

Maximum ratings

Frequency	f	1000	MHz
Anode voltage (dc)	U_A	5,0	kV
Screen grid voltage (dc)	U_{G2}	900	V
Control grid voltage (dc)	U_{G1}	– 150	V
Cathode current (dc)	I_K	3,0	A
Peak cathode current	I_{KM}	15	A
Anode dissipation	P_A	5,0	kW
Screen grid dissipation	P_{G2}	80	W
Control grid dissipation	P_{G1}	30	W

Operating characteristics

Frequency	f	170 … 230	470 … 860	MHz
Bandwidth (3 dB)	B	5,0	5,0	MHz
Output power	P_2	3,1	3,1	kW [1])
Gain	V_p	≥ 19	≥ 18	dB
Anode voltage (dc)	U_A	4,7	4,7	kV
Screen grid voltage (dc)	U_{G2}	650	650	V
Control grid voltage (dc)	U_{G1}	– 62	– 62	V
Zero-signal anode current (dc)	I_{A0}	0,6	0,6	A
Anode current (dc)	I_A	1,21	1,38	A
Screen grid current (dc)	I_{G2}	30	30	mA
Anode input power	P_{BA}	5,7	6,5	kW
Drive power	P_1	40	50	W
Anode dissipation	P_A	2,7	3,4	kW
Anode load resistance	R_A	1,9	1,7	kΩ

1) Without taking circuit losses into account.

TV sound transmitter (2 tone), class B operation, grounded control-grid screen-grid circuit

Maximum ratings

Frequency	f	1000	MHz
Anode voltage (dc)	U_A	5,0	kV
Screen grid voltage (dc)	U_{G2}	900	V
Control grid voltage (dc)	U_{G1}	– 150	V
Cathode current (dc)	I_K	3,0	A
Peak cathode current	I_{KM}	15	A
Anode dissipation	P_A	5,0	kW
Screen grid dissipation	P_{G2}	80	W
Control grid dissipation	P_{G1}	30	W

Operating characteristics

Frequency	f	170 ... 230	470 ... 860	MHz
Bandwidth (3 dB)	B	4,0	4,0	MHz
Output power, tone 1 + tone 2	P_2	1,6 + 0,32	1,6 + 0,32	kW [1] [2]
Gain	V_p	≥ 18	≥ 17	dB
Anode voltage (dc)	U_A	4,7	4,7	kV
Screen grid voltage (dc)	U_{G2}	650	650	V
Control grid voltage (dc)	U_{G1}	– 62	– 62	V
Zero-signal anode current (dc)	I_{A0}	0,6	0,6	A
Anode current (dc)	I_A	1,0	1,14	A
Screen grid current (dc)	I_{G2}	30	30	mA
Anode input power	P_{BA}	4,8	5,3	kW
Drive power, tone 1 + tone 2	P_1	25 + 5	32 + 6,4	W
Anode dissipation	P_A	2,9	3,4	kW
Anode load resistance	R_A	1,7	1,5	kΩ

1) Without taking circuit losses into account.
2) 242 kHz carrier spacing.

Transmitter Tetrode

RS 1054

Amplifier for TV transmitters with common vision and sound carrier transmission, grounded control-grid screen-grid circuit, vision-to-sound ratio 10:1, standard G

Maximum ratings

Frequency	f	1000	MHz
Anode voltage (dc)	U_A	5,0	kV
Screen grid voltage (dc)	U_{G2}	900	V
Control grid voltage (dc)	U_{G1}	– 150	V
Cathode current (dc)	I_K	3,0	A
Peak cathode current	$I_{K\,M}$	15	A
Anode dissipation	P_A	5,0	kW
Screen grid dissipation	P_{G2}	80	W
Control grid dissipation	P_{G1}	30	W

Operating characteristics

Frequency	f	170 ... 230	470 ... 860	MHz
Bandwidth (1 dB)	B	9,0	9,0	MHz
Output power, sync level	$P_{2\,SY}$	2,7/0,27	2,6/0,26	kW [1])
Gain	V_p	≥ 18	≥ 16	dB
3-tone intermodulation ratio	a_{IM3}	≥ 52	≥ 52	dB
Anode voltage (dc)	U_A	4,7	4,6	kV
Screen grid voltage (dc)	U_{G2}	650	800	V
Control grid voltage (dc)	U_{G1}	– 54	– 75	V
Peak control grid voltage (ac), sync level	$U_{g1\,m\,SY}$	40	68	V
Zero-signal anode current (dc)	$I_{A\,0}$	1,1	0,8	A
Anode current (dc), black level	$I_{A\,SW}$	1,45	1,5	A
Screen grid current (dc), black level	$I_{G2\,SW}$	35	35	mA
Anode input power, black level	$P_{B\,A\,SW}$	6,8	6,9	kW
Drive power, sync level	$P_{1\,SY}$	43	65	W
Drive power, sound	$P_{1\,Ton}$	4,3	6,5	W
Anode dissipation, black level	$P_{A\,SW}$	4,95	4,9	kW
Anode load resistance	R_A	1,2	1,0	kΩ

1) Without taking circuit losses into account.

Tube mounting

Axis vertical, anode up or down.

Spring contact rings are suitable connectors for cathode, control grid, screen grid and anode. The spring tension must be dimensioned such that the required power for inserting and withdrawing the tube remains below 120 N. Recommended pull-off power per spring contact ring is approx. 16 N. For further details see "Explanations on Technical Data".

Maximum tube surface temperature

The temperature of the electrode terminals and ceramic insulators must not exceed 220 °C. For keeping below this maximum temperature an air flow is required to cool the terminal rings. For this purpose the terminal contacts must be designed for providing a uniform cooling effect.

Forced-air cooling (RS 1054 L)

The minimum air flow rate required for maximum anode dissipation is given in the cooling air diagram, valid for 25 °C inlet temperature at 1 bar air pressure (sea level). The cooling air must be supplied from the electrode terminal side. For detailed information on forced-air cooling refer to "Explanations on Technical Data".

Vapor condensation cooling (RS 1054 SK)

The cooling water diagram gives the minimum water flow rate (distilled or deionized water) for maximum anode dissipation, as well as pressure drop and water outlet temperature at 70 °C water inlet temperature. The diagram applies to a hermetically sealed cooling system with 1,5 bar overpressure at the tube's cooling water outlet and with a maximum permissible water outlet temperature of 100 °C.

Operation with open cooling cycle (without overpressure) is also possible if the maximum outlet temperature remains below 70 °C (sea level, air pressure ≈ 1 bar) with lower inlet temperature and, if required, increased water flow rate.

For more information on vapor condensation cooling refer to "Explanations on Technical Data".

Automatic heating power regulation

Recommendations for automatic heating power stabilization are contained in the instruction "UHF TV Tetrodes, Heating Power Adjustment", which is supplied upon request.

Safety precautions

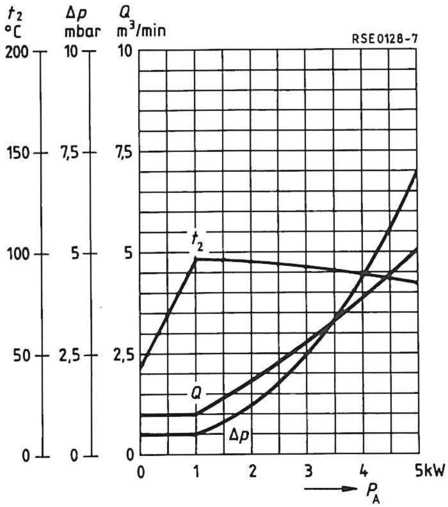
The section "Safety precautions" under "Explanations on Technical Data" describes how the tube is to be protected against damage due to electric overload or insufficient cooling. A copper wire with Ø 0,12 mm should be used to test the anode overcurrent trip circuit.

For protecting RS 1054 L against thermal anode overload the tube fuse RöSich2 is recommended. In conjunction with pull switch RöKt11 it disconnects the voltages at the tube in case of overload (accessories).

Transmitter off-periods

Frequent switching of the heating reduces lifetime. So the heating (and cooling) should be left on during transmitter off-periods of up to two hours. Continuous heating with reduced power (black heating) should be provided for longer off-periods. Refer to "Explanations on Technical Data".

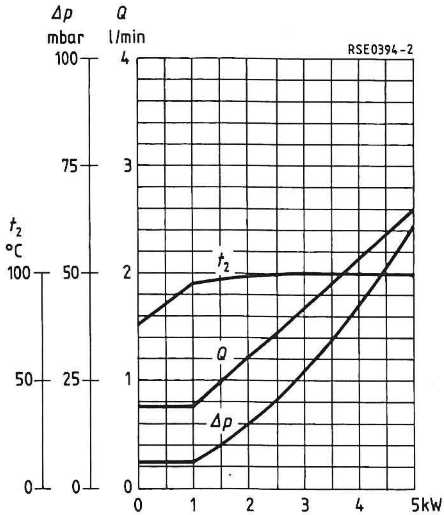
Cooling air diagram (RS 1054 L)



The cooling air is supplied from the electrode terminal side.

Air pressure = 1 bar
t_1 = 25 °C

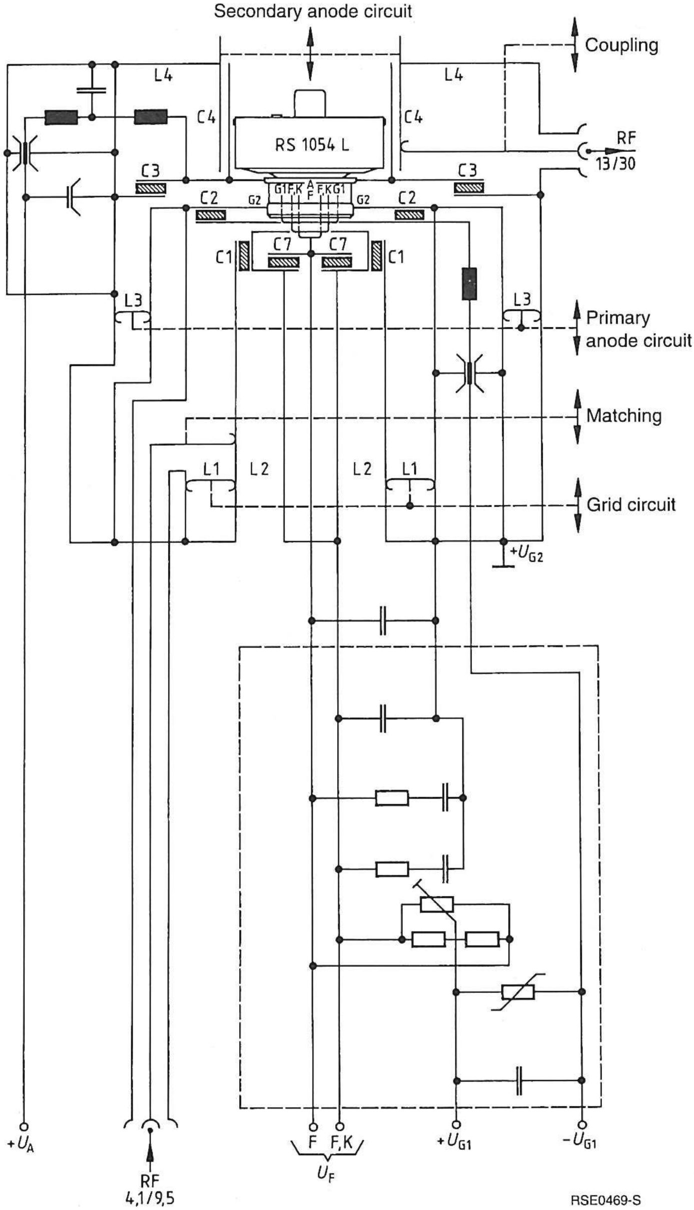
Cooling water diagram (RS 1054 SK)



Closed cooling cycle with distilled water.

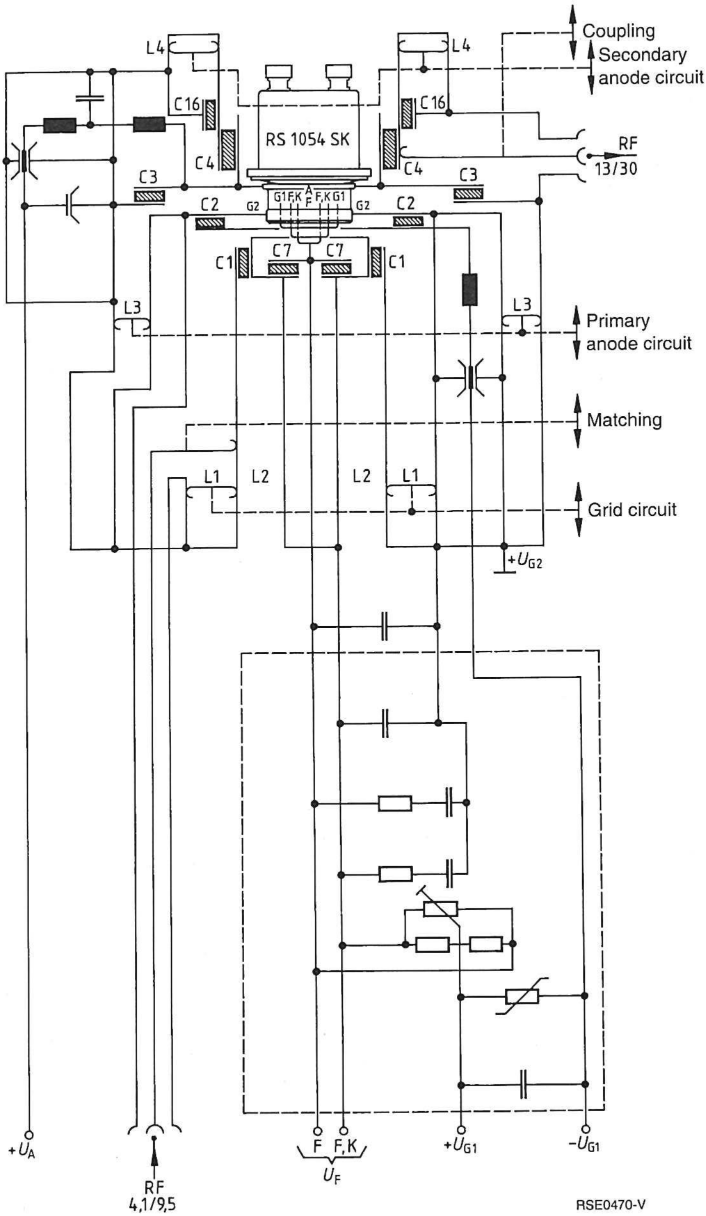
Overpressure = 1,5 bar
t_1 = 70 °C

Basic circuit diagram of final-stage cavity



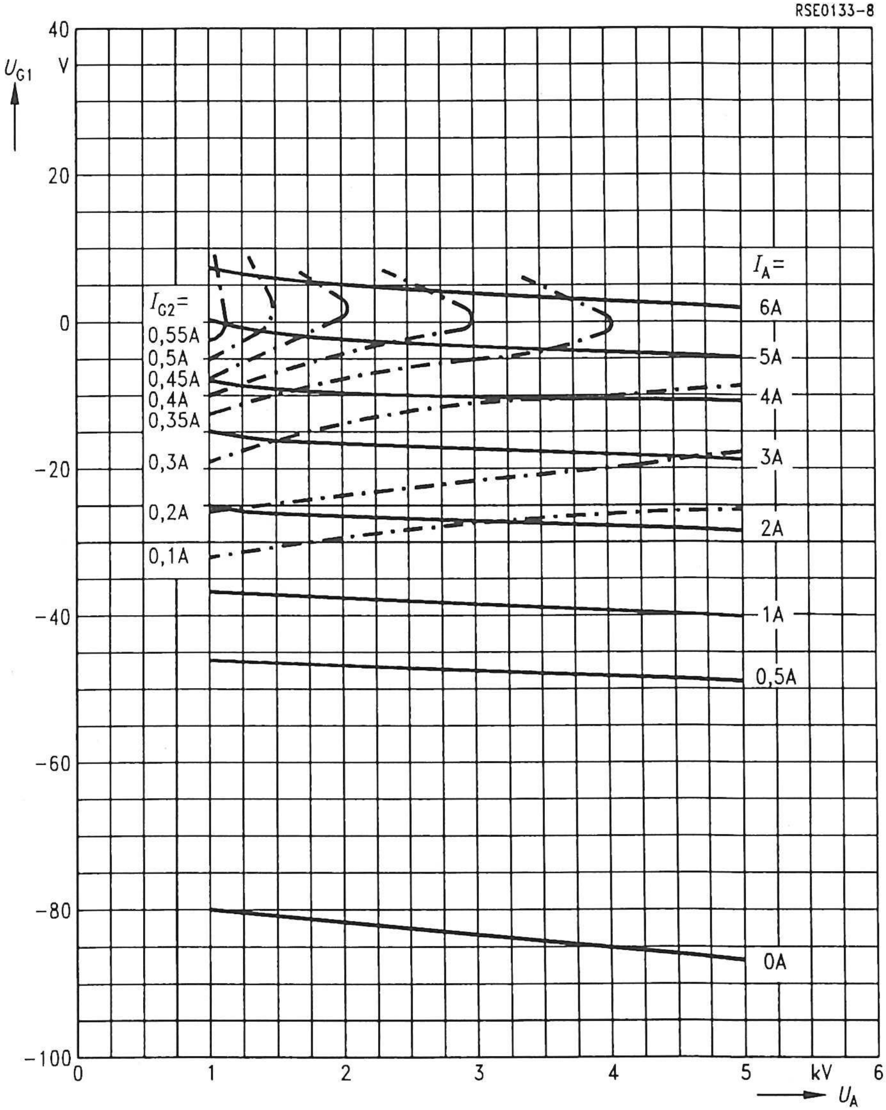
RSE0469-S

Basic circuit diagram of final-stage cavity

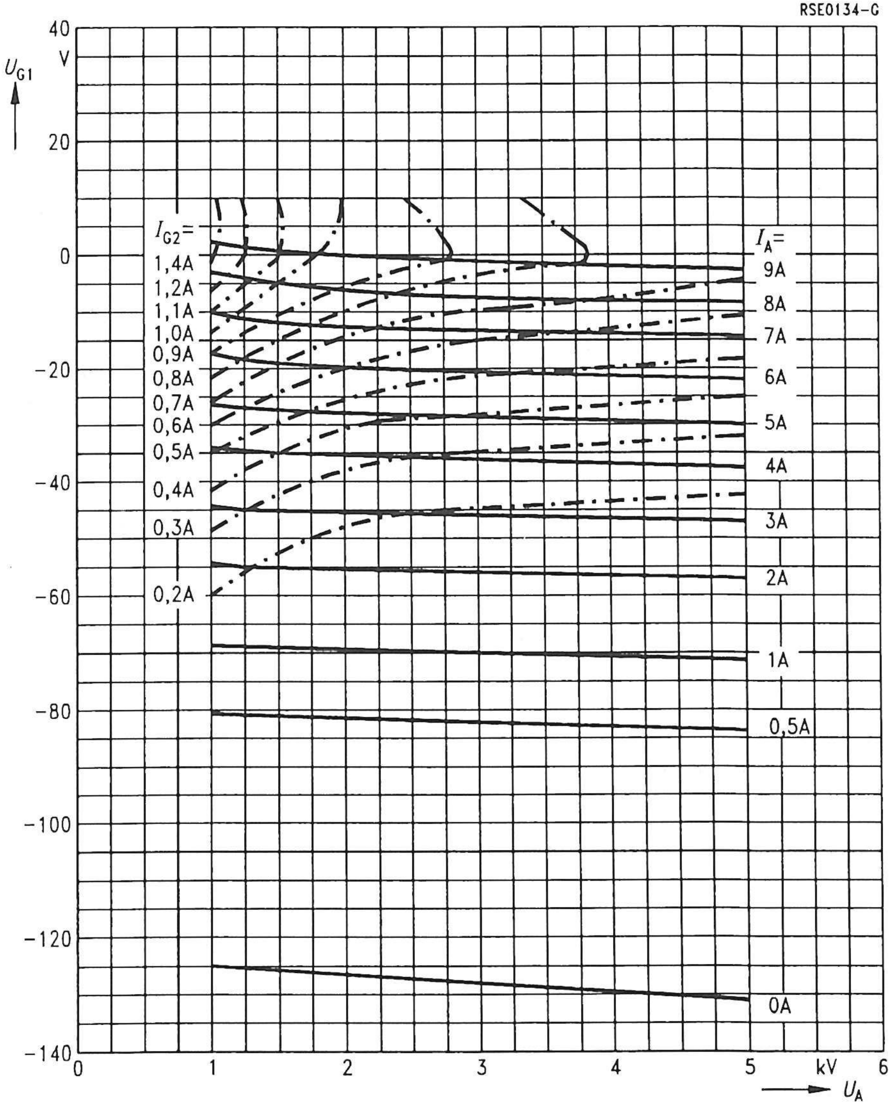


$U_{G1} = f(U_A)$ Parameter = I_A ————————

$U_{G2} = 500$ V Parameter = I_{G2} —·—·—·—·—·—



$U_{G1} = f(U_A)$ Parameter = I_A ————————
$U_{G2} = 800$ V Parameter = I_{G2} —·—·—·—·—·—

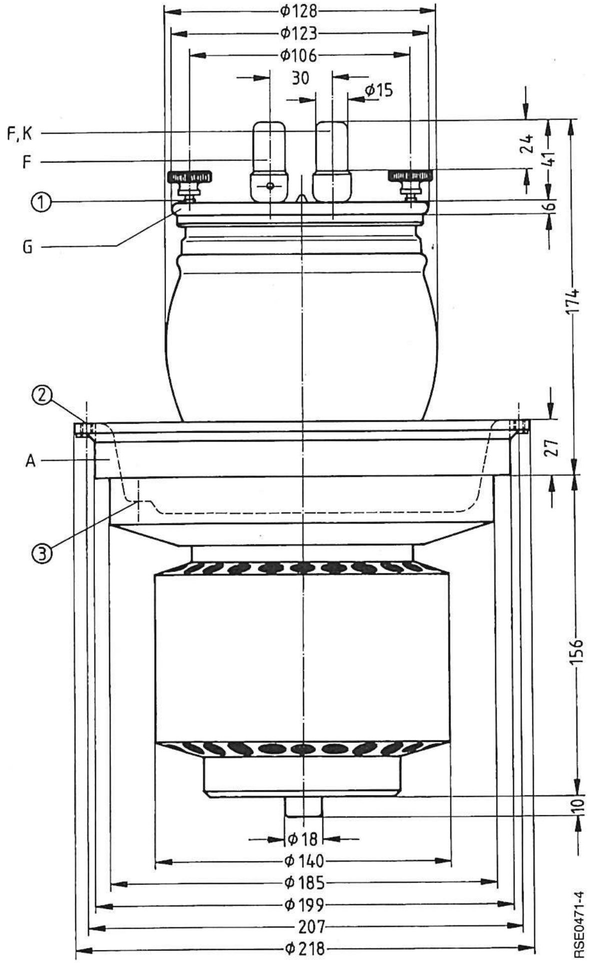


VX

Ordering code Q53-X1081

Vapor-cooled triode with coaxial grid lead-through, particularly suitable for RF amplifiers and modulators.

When used as RF amplifier, the tube can be operated at 15 kV up to 10 MHz and at 12 kV up to 30 MHz.



Dimensions in mm

① 12 tapholes M5 (12 × 30°)
② Taphole M6 for screw-in handle RöZub31V
③ Taphole M5 for tube fuse RöSich4

Approx. weight 13 kg

Heating

Heater voltage	U_F	8,0	V
Heater current	I_F	≈ 115	A
Heating: direct			
Cathode: thoriated tungsten			

Characteristics

Emission current at $U_A = U_G = 450$ V	I_{em}	30	A
Amplification factor at $U_A = 1$ to 6 kV, $I_A = 1$ A	μ	45	
Transconductance at $U_A = 3$ kV, $I_A = 1$ A	s	35	mA/V

Capacitances

Cathode/grid	c_{kg}	≈ 80	pF
Cathode/anode	c_{ka}	≈ 1,0	pF [1])
Grid/anode	c_{ga}	≈ 33	pF

Accessories

Accessories		Ordering code
Mounting instruction	RöMo64	
Mounting instruction	RöMo75	
Cathode connecting strip (2 for each tube)	RöKat221	Q81-X1136
Socket wrench for tube fuse	RöZub10	Q81-X2110
Handle	RöZub31V	Q81-X2133
Tube fuse	RöSich4	Q81-X1404
Pull switch for tube fuse	RöKt11	Q81-X1311
Boiler	RöKüV221	Q81-X1681
Insulating pipe at water inlet	RöKüV31Zub4	Q81-X1634
Union at water inlet	RöKüV31Zub7	Q81-X1637
Insulating pipe at vapor outlet	RöKüV201Zub3	Q81-X1673
Gasket at vapor outlet	RöKüV201Zub8	Q81-X1678
Insulator	RöKüV221Zub5K	Q81-X1686
Water level stabilizer with control electrodes	RöZubV4	Q81-X2105
LL electrolytic target	RöEl21	C65055-A667-A21
Gasket ring for boiler	RöN9373	C65051-A182-C506

1) Measured by means of a 30 cm × 30 cm screening plate in the grid terminal plane.

RF amplifier,
class B operation, grounded cathode circuit

Maximum ratings

Frequency	f	10	30	MHz
Anode voltage (dc)	U_A	15	12,5	kV
Grid voltage (dc)	U_G	– 1000	– 1000	V
Cathode current (dc)	I_K	8,0	8,0	A
Peak cathode current	$I_{K\,M}$	30	30	A
Anode dissipation	P_A	45	45	kW
Grid dissipation	P_G	500	500	W

Operating characteristics

Frequency	f	≤ 30	≤ 30	≤ 30	MHz
Output power	P_2	45	45	35	kW [1])
Anode voltage (dc)	U_A	12	10	8,0	kV
Grid voltage (dc)	U_G	– 250	– 200	– 160	V
Peak grid voltage (ac)	$U_{g\,m}$	560	550	510	V
Anode current (dc)	I_A	5,15	6,25	6,2	A
Grid current (dc)	I_G	1,0	1,25	1,35	A
Anode input power	$P_{B\,A}$	61,8	62,5	49,6	kW
Drive power	P_1	500	630	620	W [1])
Anode dissipation	P_A	16,8	17,5	14,6	kW
Grid dissipation	P_G	260	380	400	W
Efficiency	η	73	72	71	%
Anode load resistance	R_A	1470	1000	800	Ω

1) Circuit losses are not included.

RF amplifier,
class C operation, grounded cathode circuit

Maximum ratings

Frequency	f	10	30	MHz
Anode voltage (dc)	U_A	15	12,5	kV
Grid voltage (dc)	U_G	– 1000	– 1000	V
Cathode current (dc)	I_K	8,0	8,0	A
Peak cathode current	$I_{K\,M}$	30	30	A
Anode dissipation	P_A	45	45	kW
Grid dissipation	P_G	500	500	W

Operating characteristics

Frequency	f	$\leq$ 30	$\leq$ 30	$\leq$ 30	MHz
Output power	P_2	45	35	26	kW [1])
Anode voltage (dc)	U_A	12	10	8,0	kV
Grid voltage (dc)	U_G	– 450	– 415	– 380	V
Peak grid voltage (ac)	$U_{g\,m}$	780	740	700	V
Anode current (dc)	I_A	4,6	4,4	4,2	A
Grid current (dc)	I_G	0,95	0,95	0,95	A
Anode input power	$P_{B\,A}$	55,2	44	33,6	kW
Drive power	P_1	685	650	610	W [1])
Anode dissipation	P_A	10,2	9,0	7,6	kW
Grid dissipation	P_G	260	255	250	W
Efficiency	η	81,5	79,5	77,5	%
Anode load resistance	R_A	1395	1210	1000	Ω

1) Circuit losses are not included.

Anode voltage modulation, grounded cathode circuit

Maximum ratings

Frequency	f	30	MHz
Anode voltage (dc)	U_A	10,5	kV
Grid voltage (dc)	U_G	– 1000	V
Cathode current (dc)	I_K	8,0	A
Peak cathode current	$I_{K\,M}$	30	A
Anode dissipation	P_A	45	kW
Grid dissipation	P_G	500	W

Operating characteristics

Frequency	f	≤ 30	MHz
Carrier power	P_{trg}	22	kW 1)
Anode voltage (dc)	U_A	10	kV
Grid bias (dc), fixed	$U_{G\,fix}$	– 195	V
Grid resistance	R_G	300	Ω
Peak grid voltage (ac)	$U_{g\,m}$	775	V
Anode current (dc)	I_A	2,75	A
Grid current (dc)	I_G	1,0	A
Anode input power	$P_{B\,A}$	27,5	kW
Drive power	P_1	725	W 1)
Anode dissipation	P_A	5,5	kW 2)
Grid dissipation	P_G	230	W
Efficiency	η	80	%
Anode load resistance	R_A	2230	Ω
Modulation factor	m	100	%
Modulation power	P_{mod}	13,75	kW
Grid current (dc)	I_G	1,2	A 3)
Drive power	P_1	940	W 1) 3)
Grid current (dc)	I_G	0,85	A 4)
Drive power	P_1	605	W 1) 4)

1) Circuit losses are not included.
2) Even during modulation the indicated maximum ratings must not be exceeded. It has to be observed that during 100 % modulation the plate dissipation increases to about 1,5 times the power dissipation stated for the carrier value.
3) Maximum values at $U_A = 0$ V.
4) Maximum values at peak modulation.

VX

AF amplifier and modulator,
class B operation, 2 tubes in push-pull circuit

Maximum ratings

Anode voltage (dc)	U_A	12	kV
Grid voltage (dc)	U_G	– 1000	V
Cathode current (dc)	I_K	8,0	A
Peak cathode current	I_{KM}	30	A
Anode dissipation	P_A	45	kW
Grid dissipation	P_G	500	W

Operating characteristics

P_2	0	80	0	60	0	55	kW
U_A	10	10	10	10	8,0	8,0	kV
U_G	– 185	– 185	– 185	– 185	– 150	– 150	V
$U_{gg\,m}$	0	2 × 485	0	2 × 425	0	2 × 430	V
I_A	2 × 0,3	2 × 6,3	2 × 0,3	2 × 4,5	2 × 0,3	2 × 5,4	A
I_G	0	2 × 0,9	0	2 × 0,65	0	2 × 0,9	A
I_{GM}	0	2 × 4,5	0	2 × 3,4	0	2 × 4,3	A
P_{BA}	2 × 3	2 × 63	2 × 3	2 × 45	2 × 2,4	2 × 43,2	kW
P_1	0	2 × 380	0	2 × 240	0	2 × 335	W
P_A	2 × 3	2 × 23	2 × 3	2 × 15	2 × 2,4	2 × 15,7	kW
P_G	0	2 × 220	0	2 × 125	0	2 × 200	W
η	–	63,5	–	66,6	–	64	%
R_{AA}	–	1600	–	2410	–	1535	Ω

VX

Tube mounting

Axis vertical, anode down.

For connection of the cathode use the terminals listed under "Accessories".

For connecting the grid, M5 tapholes are provided at the grid terminal ring; knurled head screws are included in delivery.

Maximum tube surface temperature

The temperature of the tube's glass and metal parts and of the cathode terminals must not exceed 220 °C at any point.

Vapor cooling

Cooling data for maximum anode dissipation	$P_{A\,max}$ = 45 kW
Total power to be dissipated by the cooling system (P_A + P_G + 0,8 P_F)	46,2 kW
Equivalent thermal output	2770 kJ/min (665 kcal/min)
Flow rate of returning water	
at returning water temperature of 20 °C	approx. 1,1 l/min
at returning water temperature of 90 °C	approx. 1,3 l/min
Volume of generated vapor	
at returning water temperature of 20 °C	approx. 1,8 m^3/min
at returning water temperature of 90 °C	approx. 2,1 m^3/min

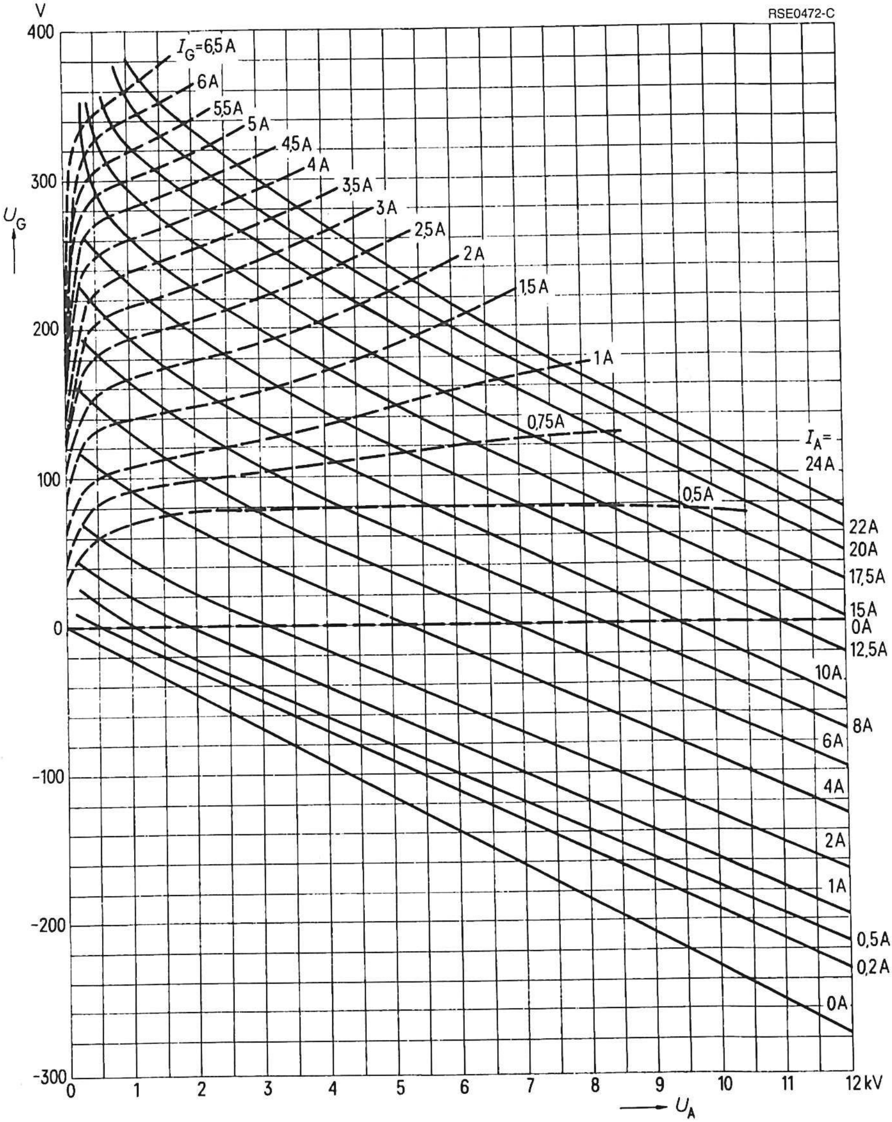
Detailed information on vapor cooling upon request. Please observe instructions on vapor cooling given under "Explanations on Technical Data".

Safety precautions

The section "Safety precautions" under "Explanations on Technical Data" describes how the tube is to be protected against damage due to electric overload or insufficient cooling. A copper wire with 0,26 mm diameter should be used to test the anode overcurrent trip circuit.

For protection against thermal anode overload the tube fuse RöSich4 is recommended. In conjunction with pull switch RöKt11 it disconnects the voltages at the tube in case of overload (see accessories).

$U_G = f(U_A)$ Parameter = I_A ———————
Parameter = I_G — — — — — — — —



For single-sideband transmitters and TV transmitters

Coaxial metal-ceramic tetrode for frequencies up to 250 MHz, forced-air-cooled or vapor-cooled, particularly suitable for single-sideband transmitters in professional communications engineering, for broadcast transmitters up to 50 kW and TV transmitters, band III.

Forced-air-cooled version

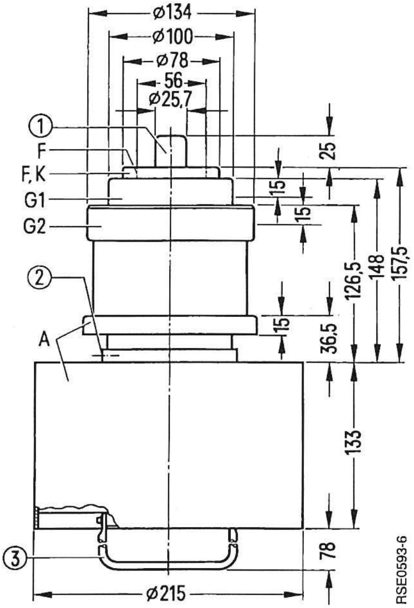
RS 1082 CL

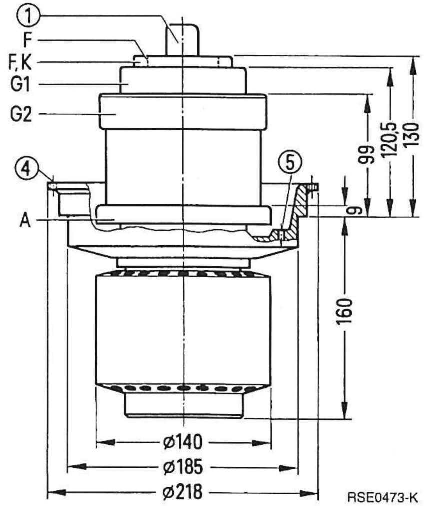
Ordering code Q51-X1082

Vapor-cooled version

RS 1082 CV

Ordering code Q53-X1082





Dimensions in mm

① Do not use as terminal
② Taphole M5 for tube fuse RöSich1
③ Handle, swingable
④ Taphole M6 for screw-in handle RöZub31V
⑤ Taphole M5 for tube fuse RöSich4

Approx. weight 16 kg

Approx. 14,5 kg

Heating

Heater voltage	U_F	10	V
Heater current	I_F	≈ 200	A
Heating: direct			
Cathode: thoriated tungsten			

Characteristics

Emission current at $U_A = U_{G2} = U_{G1} = 500$ V	I_{em}	80	A
Amplification factor of screen grid at $U_A = 3$ kV, $U_{G2} = 800$ to 1200 V, $I_A = 2{,}5$ A	μ_{g2g1}	6,6	
Transconductance at $U_A = 3$ kV, $U_{G2} = 1200$ V, $I_A = 2{,}5$ A	s	65	mA/V

Capacitances

Cathode/control grid	c_{kg1}	≈ 125	pF
Cathode/screen grid	c_{kg2}	≈ 10	pF
Cathode/anode	c_{ka}	≈ 0,2	pF 1)
Control grid/screen grid	c_{g1g2}	≈ 155	pF
Control grid/anode	c_{g1a}	≈ 1,6	pF 1)
Screen grid/anode	c_{g2a}	≈ 40	pF

Accessories
RS 1082 CL

		Ordering code
Internal cathode terminal	RöKat82a	Q81-X1182
External cathode terminal	RöKat82b	Q81-X1184
Header socket for cathode and control grid with cathode blocking	RöKat82c	Q81-X1183
Control grid terminal	RöGit82a	Q81-X982
Screen grid terminal	RöGit82b	Q81-X983
Screen grid terminal with blocking	RöGit82d	Q81-X985
SW header socket with screen grid blocking against control grid	RöKpf82G	Q81-X1852
SW header socket with screen grid blocking against cathode	RöKpf82K	Q81-X1851
Socket wrench for tube fuse	RöZub10	Q81-X2110
Tube fuse	RöSich1	Q81-X1401
Pull switch for tube fuse	RöKt11	Q81-X1311
Joining piece for air duct	RöAnst360	Q81-X744

1) Measured by means of a 40 cm × 40 cm screening plate in the screen grid terminal plane.

Accessories
RS 1082 CV

		Ordering code
Mounting instruction	RöMo64	
Mounting instruction	RöMo75	
Internal cathode terminal	RöKat82a	Q81-X1182
External cathode terminal	RöKat82b	Q81-X1184
Header socket for cathode and control grid with cathode blocking	RöKat82c	Q81-X1183
Control grid terminal	RöGit82a	Q81-X982
Screen grid terminal	RöGit82b	Q81-X983
Screen grid terminal with blocking	RöGit82d	Q81-X985
SW header socket with screen grid blocking against control grid	RöKpf82G	Q81-X1852
SW header socket with screen grid blocking against cathode	RöKpf82K	Q81-X1851
Socket wrench for tube fuse	RöZub10	Q81-X2110
Handle	RöZub31V	Q81-X2133
Tube fuse	RöSich4	Q81-X1404
Pull switch for tube fuse	RöKt11	Q81-X1311
Boiler	RöKüV221	Q81-X1681
Insulating pipe at water inlet	RöKüV31Zub4	Q81-X1634
Union at water inlet	RöKüV31Zub7	Q81-X1637
Insulating pipe at vapor outlet	RöKüV201Zub3	Q81-X1673
Gasket at vapor outlet	RöKüV201Zub8	Q81-X1678
Insulator	RöKüV221Zub5K	Q81-X1686
Water level stabilizer with control electrodes	RöZubV4	Q81-X2105
LL electrolytic target	RöEl21	C65055-A667-A21
Gasket for boiler	RöN9373	C65051-A182-C506

Anode and screen grid modulation, class C operation, grounded cathode circuit

Maximum ratings

Frequency	f	30	MHz
Anode voltage (dc)	U_A	10,5	kV
Screen grid voltage (dc)	U_{G2}	900	V
Control grid voltage (dc)	U_{G1}	– 500	V
Cathode current (dc)	I_K	15	A
Peak cathode current	$I_{K\,M}$	80	A
Anode dissipation (RS 1082 CL)	P_A	30	kW
Anode dissipation (RS 1082 CV)	P_A	45	kW
Screen grid dissipation	P_{G2}	600	W
Control grid dissipation	P_{G1}	300	W

Operating characteristics

Frequency	f	≤ 30	MHz
Carrier power	P_{trg}	55	kW [1]
Anode voltage (dc)	U_A	10	kV
Screen grid voltage (dc)	U_{G2}	800	V
Control grid bias (dc), fixed	$U_{G1\,fix}$	– 340	V
Control grid resistance	R_{G1}	300	Ω
Peak control grid voltage (ac)	$U_{g1\,m}$	610	V
Anode current (dc)	I_A	6,9	A
Screen grid current (dc)	I_{G2}	0,5	A
Control grid current (dc)	I_{G1}	0,36	A
Anode input power	$P_{B\,A}$	69	kW
Drive power	P_1	200	W [1]
Anode dissipation	P_A	14	kW [2]
Screen grid dissipation	P_{G2}	400	W
Control grid dissipation	P_{G1}	40	W
Efficiency	η	80	%
Anode load resistance	R_A	780	Ω
Modulation factor	m	100	%
Peak screen grid voltage (ac)	$U_{g2\,m}$	600	V [3]
Modulation power	P_{mod}	35	kW
Control grid current (dc)	I_{G1}	0,51	A [4]
Drive power	P_1	280	W [1] [4]
Anode dissipation at modulation	$P_{A\,mod}$	23	kW [5]
Screen grid dissipation at modulation	$P_{G2\,mod}$	400	W [5]

1) Circuit losses are not included.
2) Even during modulation the indicated maximum ratings must not be exceeded. It has to be observed that the plate dissipation will increase to about 1,5 times the power dissipation stated for the carrier value during 100 % modulation.
3) Modulation of screen grid via separate transformer winding.
4) Maximum values at $U_A = 0$ V.
5) Average values at $m = 100$ %.

VX

RF linear amplifier,
SSB modulation, grounded cathode circuit, $I_{G1} = 0$

Maximum ratings

Frequency		f	30	MHz
Anode voltage (dc)		U_A	12	kV
Screen grid voltage (dc)		U_{G2}	1400	V
Control grid voltage (dc)		U_{G1}	– 350	V
Cathode current (dc)		I_K	15	A
Peak cathode current		$I_{K\,M}$	80	A
Anode dissipation	(RS 1082 CL)	P_A	30	kW
Anode dissipation	(RS 1082 CV)	P_A	45	kW
Screen grid dissipation		P_{G2}	600	W
Control grid dissipation		P_{G1}	300	W

Operating characteristics

		I	II [1]	III [1]	
Output power	P_2	0	33	16,5	kW [2]
Anode voltage (dc)	U_A	10	10	10	kV
Screen grid voltage (dc)	U_{G2}	1200	1200	1200	V
Control grid voltage (dc)	U_{G1}	– 185	– 185	– 185	V
Peak control grid voltage (ac)	$U_{g1\,m}$	0	160	160	V
Anode current (dc)	I_A	2,0	5,2	3,3	A
Screen grid current (dc)	I_{G2}	0	250	80	mA
Anode input power	$P_{B\,A}$	20	52	33	kW
Anode dissipation	P_A	20	19	16,5	kW
Screen grid dissipation	P_{G2}	0	300	96	W
Efficiency	η	–	63	50	%
Third order intermodulation product	d_3	–	–	≥ 36	dB [3]
Fifth order intermodulation product	d_5	–	–	≥ 44	dB [3]

I No modulation
II 1-tone modulation
III 2-tone modulation

1) Carrier suppressed.
2) Circuit losses are not included.
3) Level of non-linear cross talk resulting from third and fifth order intermodulation products as measured by the 2-tone method at f = 30 MHz.

TV vision transmitter,
grounded control-grid screen-grid circuit, negative modulation

Maximum ratings

Frequency	f	230	MHz
Anode voltage (dc)	U_A	6,0	kV
Screen grid voltage (dc)	U_{G2}	1200	V
Control grid voltage (dc)	U_{G1}	– 250	V
Cathode current (dc)	I_K	15	A
Peak cathode current	$I_{K\,M}$	80	A
Anode dissipation	P_A	30	kW
Screen grid dissipation	P_{G2}	300	W
Control grid dissipation	P_{G1}	150	W

Operating characteristics

Frequency	f	≤ 230	MHz
Bandwidth (– 3 dB)	B	10	MHz
Output power, sync level	$P_{2\,SY}$	26	kW [1] [2]
Output power, black level	$P_{2\,SW}$	14,2	kW [1] [3]
Anode voltage (dc)	U_A	5,4	kV
Screen grid voltage (dc)	U_{G2}	800	V
Control grid voltage (dc)	U_{G1}	– 95	V [4]
Peak control grid voltage (ac), sync level	$U_{g1\,m\,SY}$	190	V
Anode current (dc), black level	$I_{A\,SW}$	6,0	A [3]
Screen grid current (dc), black level	$I_{G2\,SW}$	100	mA [3]
Control grid current (dc), black level	$I_{G1\,SW}$	120	mA [3]
Anode input power, black level	$P_{B\,A\,SW}$	32,5	kW [3]
Drive power, sync level	$P_{1\,SY}$	1,2	kW [5]
Anode dissipation, black level	$P_{A\,SW}$	18,3	kW [3]
Screen grid dissipation, black level	$P_{G2\,SW}$	150	W [3]
Control grid dissipation, black level	$P_{G1\,SW}$	5,0	W [3]
Anode load resistance	R_A	340	Ω
Sync. compression on/off		28/25	
Differential phase		≤ 3°	
Differential gain		≤ 90	%

1) Circuit losses are not included.
2) Only dynamically permissible.
3) Black level with gated sync. pulses.
4) For zero signal dc plate current of $I_{A\,0}$ = 1,8 A.
5) Output power required from driver stage.

VX

Tube mounting

Axis vertical, anode down. The forced-air-cooled version RS 1082 CL can also be mounted anode-up in the cavity. For this reason the tube is provided with a swingable handle at the anode base.

For connection of the tube use the terminals listed under "Accessories". The complete header sockets for broadcast and communications transmitters in the medium and short-wave range can be selected corresponding to the required circuit. For grounded cathode operation in communications transmitters the two-part short-wave header sockets (RöKat82c in conjunction with RöGit82d) can be used, if a stable base as support for the screen-grid connector flange is provided in the transmitter. The individual connectors are intended for modulator applications.

Maximum tube surface temperature

The temperature of the metal-ceramic seals of the tube must not exceed 220 °C at any point. The header sockets for transmitter applications are provided with an air inlet port through which the cooling air is evenly distributed over the connectors. The air flow rate required to keep below the specified maximum temperature is 0,6 m^3/min at a pressure drop of approx. 1,5 mbar. If separate connectors are used, an evenly distributed air flow across these parts must be provided especially at higher frequencies.

Forced-air cooling (RS 1082 CL)

The minimum air flow rate required for the maximum anode dissipation is given in the cooling air diagram, valid for an air inlet temperature of 25 °C and a normal air pressure of 1 bar (sea level). The cooling air is supplied from the electrode terminal side. For further details on forced-air cooling refer to "Explanations on Technical Data".

Vapor cooling (RS 1082 CV)

Cooling data for maximum anode dissipation	$P_{A\,max}$ = 45 kW
Total power to be dissipated by the cooling system ($P_A + P_{G2} + P_{G1} + 0{,}8\ P_F$)	47,5 kW
Equivalent thermal output	2850 kJ/min (680 kcal/min)
Quantity of returning water	
at returning water temperature of 20 °C	approx. 1,1 l/min
at returning water temperature of 90 °C	approx. 1,3 l/min
Volume of generated vapor	
at returning water temperature of 20 °C	approx. 1,9 m^3/min
at returning water temperature of 90 °C	approx. 2,1 m^3/min

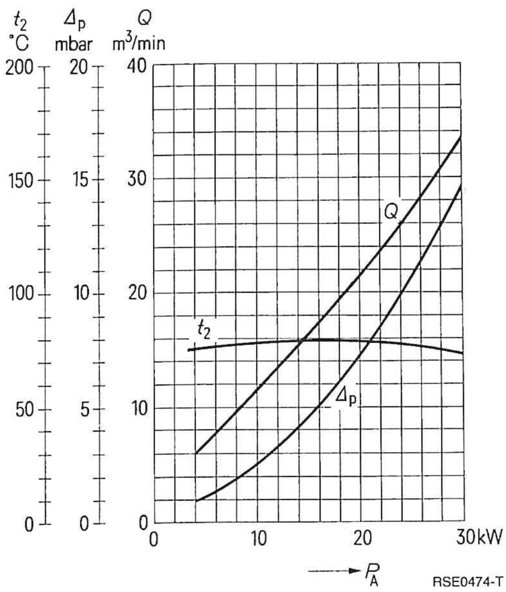
Detailed information on vapor cooling upon request. Please observe instructions on vapor cooling given under "Explanations on Technical Data".

Safety precautions

The section “Safety precautions” under “Explanations on Technical Data” describes how the tube is to be protected against damage due to electric overload or insufficient cooling. A copper wire with 0,20 mm diameter should be used to test the anode overcurrent trip circuit.

For protection against thermal anode overload the tube RöSich1/RöSich4 is recommended. In conjunction with pull switch RöKt11 it disconnects the voltages at the tube in case of overload (sea accessories).

Cooling air diagram (RS 1082 CL)



The cooling air is supplied from the electrode terminal side.

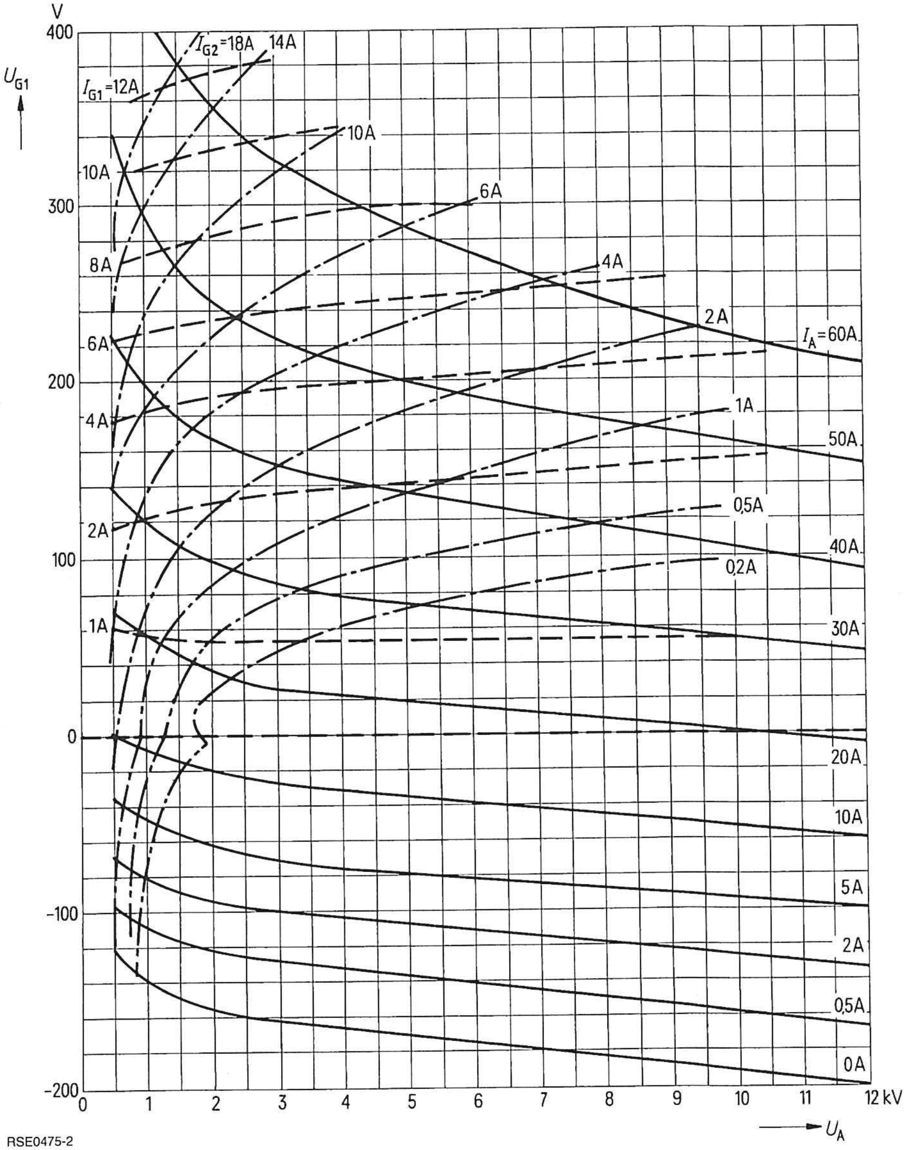
Air pressure = 1 bar

t_1 = 25 °C

VX

$U_{G1} = f(U_A)$
$U_{G2} = 800$ V

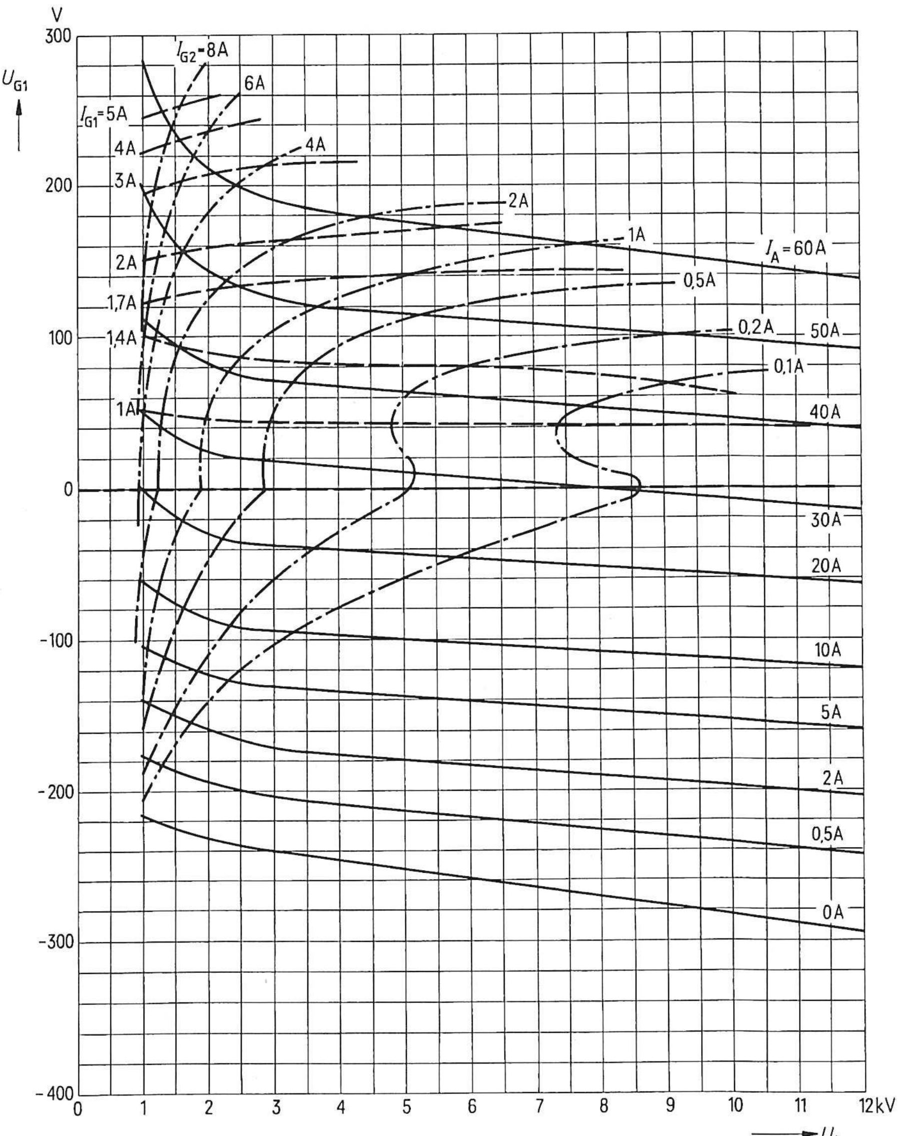
Parameter = I_A ————————
Parameter = I_{G2} —·—·—·—·—
Parameter = I_{G1} — — — — — —



RSE0475-2

$U_{G1} = f(U_A)$
$U_{G2} = 1200$ V

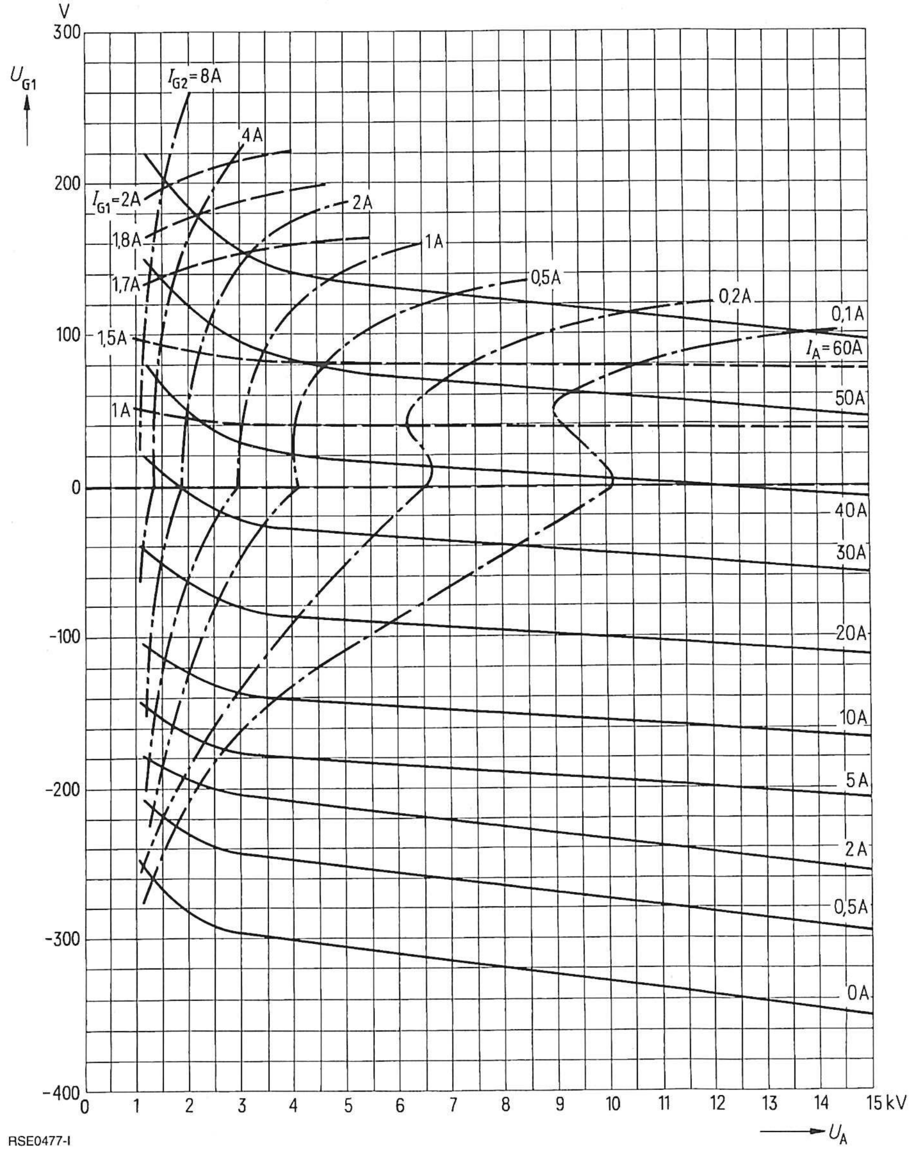
Parameter = I_A ————————
Parameter = I_{G2} —·—·—·—·—
Parameter = I_{G1} — — — — — —



RSE0476-A

VX

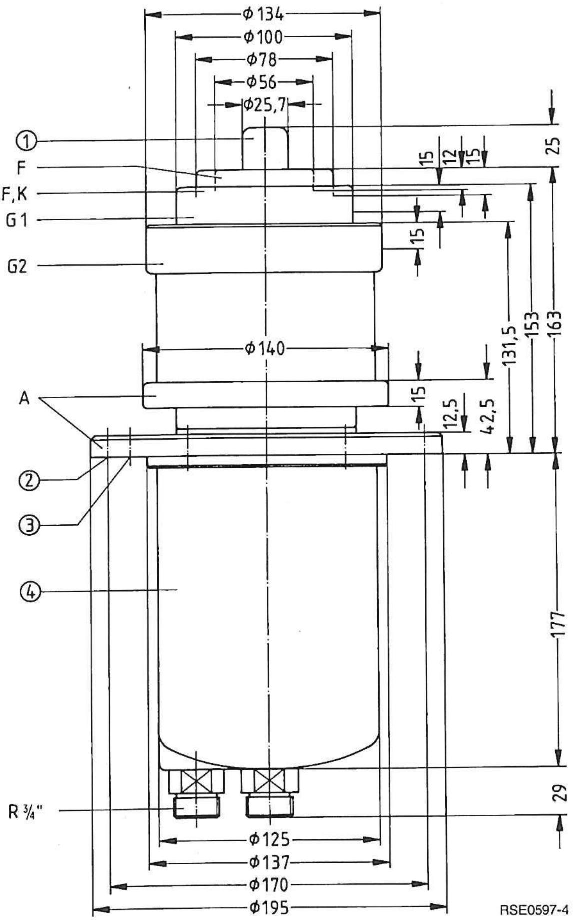
$U_{G1} = f(U_A)$ Parameter = I_A ——————
$U_{G2} = 1500$ V Parameter = I_{G2} —·—·—·—
Parameter = I_{G1} — — — — —



RSE0477-I

For broadcast and single-sideband transmitters Ordering code Q52-X1084

Coaxial metal-ceramic tetrode, water-cooled with integrated cooling jacket, for frequencies up to 250 MHz; particularly suitable for broadcast and single-sideband transmitters up to 60 kW medium and short wave.



RSE0597-4

Dimensions in mm

① Do not use as terminal
② 6 fixing holes, 11 mm dia. (6 × 60°)
③ Taphole M6 for screw-in handle RöZub184
④ Do not use boiler as anode terminal

Approx. weight 8,4 kg

VX

Heating

Heater voltage	U_F	12,5	V
Heater current	I_F	≈ 200	A
Heating: direct			
Cathode: thoriated tungsten			

Characteristics

Emission current at $U_A = U_{G2} = U_{G1} = 550$ V	I_{em}	100	A
Amplification factor of screen grid at $U_A = 3$ kV, $U_{G2} = 800$ to 1200 V, $I_A = 3$ A	μ_{g2g1}	6,6	
Transconductance at $U_A = 3$ kV, $U_{G2} = 1200$ V, $I_A = 3$ A	s	84	mA/V

Capacitances

Cathode/control grid	c_{kg1}	≈ 136	pF
Cathode/screen grid	c_{kg2}	≈ 12	pF
Cathode/anode	c_{ka}	≈ 0,3	pF [1]
Control grid/screen grid	c_{g1g2}	≈ 165	pF
Control grid/anode	c_{g1a}	≈ 1,9	pF [1]
Screen grid/anode	c_{g2a}	≈ 43	pF

Accessories		Ordering code
Internal cathode terminal	RöKat82a	Q81-X1182
External cathode terminal	RöKat82b	Q81-X1184
Header socket for cathode and control grid with cathode blocking	RöKat82c	Q81-X1183
Control grid terminal	RöGit82a	Q81-X982
Screen grid terminal	RöGit82b	Q81-X983
Screen grid terminal with blocking	RöGit82d	Q81-X985
SW header socket with screen grid blocking against control grid	RöKpf82G	Q81-X1852
SW header socket with screen grid blocking against cathode	RöKpf82K	Q81-X1851
SW header socket with screen grid blocking against cathode	RöKpf184C	Q81-X1853
Cathode connecting strip (2 for each tube)	RöKat363	Q81-X1174
LL electrolytic target for 3/4″ hose	RöEl3	Q81-X336
Handle	RöZub184	Q81-X2119

1) Measured by means of a 40 cm diameter screening plate in the screen grid terminal plane.

RF amplifier,
class B operation, grounded cathode circuit, I_{G1} = 0

Maximum ratings

Frequency	f	10	40	MHz
Anode voltage (dc)	U_A	16	12	kV
Screen grid voltage (dc)	U_{G2}	1600	1400	V
Control grid voltage (dc)	U_{G1}	– 350	– 350	V
Cathode current (dc)	I_K	15	15	A
Peak cathode current	$I_{K\,M}$	100	100	A
Anode dissipation	P_A	70	70	kW 6)
Screen grid dissipation	P_{G2}	750	750	W
Control grid dissipation	P_{G1}	350	350	W

Operating characteristics

Frequency	f	≤ 10	≤ 40	MHz
Output power	P_2	75	55	kW 1)
Anode voltage (dc)	U_A	14	11	kV
Screen grid voltage (dc)	U_{G2}	1500	1200	V
Control grid voltage (dc)	U_{G1}	– 300 2)	– 190 3)	V
Peak control grid voltage (ac)	$U_{g1\,m}$	240	165	V
Anode current (dc)	I_A	7,6	7,7	A
Screen grid current (dc)	I_{G2}	0,4	0,1	A
Anode input power	$P_{B\,A}$	106	85	kW
Drive power	P_1	580 4)	400 5)	W 1)
Anode dissipation	P_A	31	30	kW
Screen grid dissipation	P_{G2}	600	120	W
Efficiency	η	71	65	%
Anode load resistance	R_A	1040	368	Ω

1) Circuit losses are not included.
2) For zero signal dc plate current $I_{A\,0}$ = 0,4 A.
3) For zero signal dc plate current $I_{A\,Leer}$ = 2,0 A.
4) Necessary drive power at 50 Ω tube 0 preloading.
5) Necessary drive power at 35 Ω tube input preloading.
6) Higher max. ratings may be released upon request.

Anode and screen grid modulation, class C operation, grounded cathode circuit

Maximum ratings

Frequency	f	30	MHz
Anode voltage (dc)	U_A	10,5	kV
Screen grid voltage (dc)	U_{G2}	900	V
Control grid voltage (dc)	U_{G1}	– 500	V
Cathode current (dc)	I_K	15	A
Peak cathode current	$I_{K\,M}$	100	A
Anode dissipation	P_A	70	kW [6]
Screen grid dissipation	P_{G2}	750	W
Control grid dissipation	P_{G1}	350	W

Operating characteristics

Frequency	f	≤ 30	MHz
Carrier power	P_{trg}	66	kW [1]
Anode voltage (dc)	U_A	10	kV
Screen grid voltage (dc)	U_{G2}	800	V
Control grid bias (dc), fixed	$U_{G1\,fix}$	– 300	V
Control grid resistance	R_{G1}	250	Ω
Peak control grid voltage (ac)	$U_{g1\,m}$	500	V
Anode current (dc)	I_A	8,2	A
Screen grid current (dc)	I_{G2}	550	mA
Control grid current (dc)	I_{G1}	360	mA
Anode input power	$P_{B\,A}$	82	kW
Drive power	P_1	160	W [1]
Anode dissipation	P_A	16	kW [2]
Screen grid dissipation	P_{G2}	440	W
Control grid dissipation	P_{G1}	20	W
Efficiency	η	80	%
Anode load resistance	R_A	650	Ω
Modulation factor	m	100	%
Peak screen grid voltage (ac)	$U_{g2\,m}$	500	V [3]
Modulation power	P_{mod}	41	kW
Control grid current (dc)	I_{G1}	400	mA [4]
Drive power	P_1	180	W [1] [4]
Anode dissipation at modulation	$P_{A\,mod}$	28	kW [5]
Screen grid dissipation at modulation	$P_{G2\,mod}$	660	W [5]

1) Circuit losses are not included.
2) Even during modulation the indicated maximum ratings must not be exceeded. It has to be observed that during 100 % modulation the plate dissipation increases to about 1,5 times the power dissipation stated for the carrier value.
3) Screen grid modulation via separate transformer winding.
4) Maximum values at U_A = 0 V.
5) Average values m = 100 %.
6) Higher max. ratings may be released upon request.

RF linear amplifier,
single-sideband modulation, grounded cathode circuit, $I_{G1} = 0$

Maximum ratings

Frequency	f	30	MHz
Anode voltage (dc)	U_A	12	kV
Screen grid voltage (dc)	U_{G2}	1400	V
Control grid voltage (dc)	U_{G1}	– 350	V
Cathode current (dc)	I_K	15	A
Peak cathode current	$I_{K\,M}$	100	A
Anode dissipation	P_A	70	kW [4]
Screen grid dissipation	P_{G2}	750	W
Control grid dissipation	P_{G1}	350	W

Operating characteristics

		I	II [1]	III [1]	
Output power	P_2	0	44	22	kW [2]
Anode voltage (dc)	U_A	10	10	10	kV
Screen grid voltage (dc)	U_{G2}	1200	1200	1200	V
Control grid voltage (dc)	U_{G1}	– 170	– 170	– 170	V
Peak control grid voltage (ac)	$U_{g1\,m}$	0	150	150	V
Anode current (dc)	I_A	2,6	7,0	4,5	A
Screen grid current (dc)	I_{G2}	0	300	100	mA
Anode input power	$P_{B\,A}$	26	70	45	kW
Anode dissipation	P_A	26	26	23	kW
Screen grid dissipation	P_{G2}	0	360	120	W
Efficiency	η	–	63	49	%
Anode load resistance	R_A	–	730	730	Ω
Third order intermodulation product	d_3	–	–	≥ 34	dB [3]
Fifth order intermodulation product	d_5	–	–	≥ 44	dB [3]

I No modulation
II 1-tone modulation
III 2-tone modulation

1) Carrier suppressed.
2) Circuit losses are not included.
3) Level of non-linear cross talk resulting from third and fifth order intermodulation products as measured by the 2-tone method at f = 30 MHz.
4) Higher max. ratings may be released upon request.

VX

Tube mounting

Axis vertical, anode up or down.

For connection of the tube use the header sockets listed under "Accessories". For application in modulators individual connectors may be used if sufficient cooling is provided.

Maximum tube surface temperature

The temperature of the tube's metal-ceramic seals must not exceed 220 °C at any point. The header sockets for transmitter operation are equipped with an air inlet port through which the cooling air is evenly distributed over the connectors. The air flow rate required to keep below the specified maximum temperature is 0,6 m^3/min at a pressure drop of 1,5 mbar. If separate connectors are used, an evenly distributed air flow across these parts must be provided.

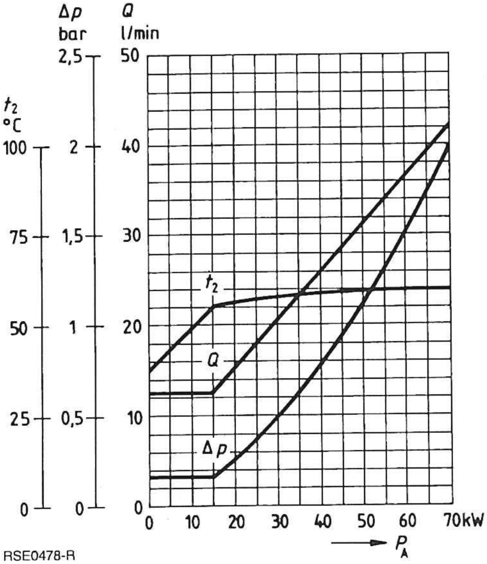
Water cooling

The cooling water diagram is valid for 35 °C water inlet temperature. The pressure of the cooling water must not exceed 6 bar. Please observe instructions on water cooling given under "Explanations on Technical Data".

Safety precautions

The section "Safety precautions" under "Explanations on Technical Data" describes how the tube is to be protected against damage due to electric overload or insufficient cooling. A copper wire with 0,20 mm diameter should be used to test the anode overcurrent trip circuit.

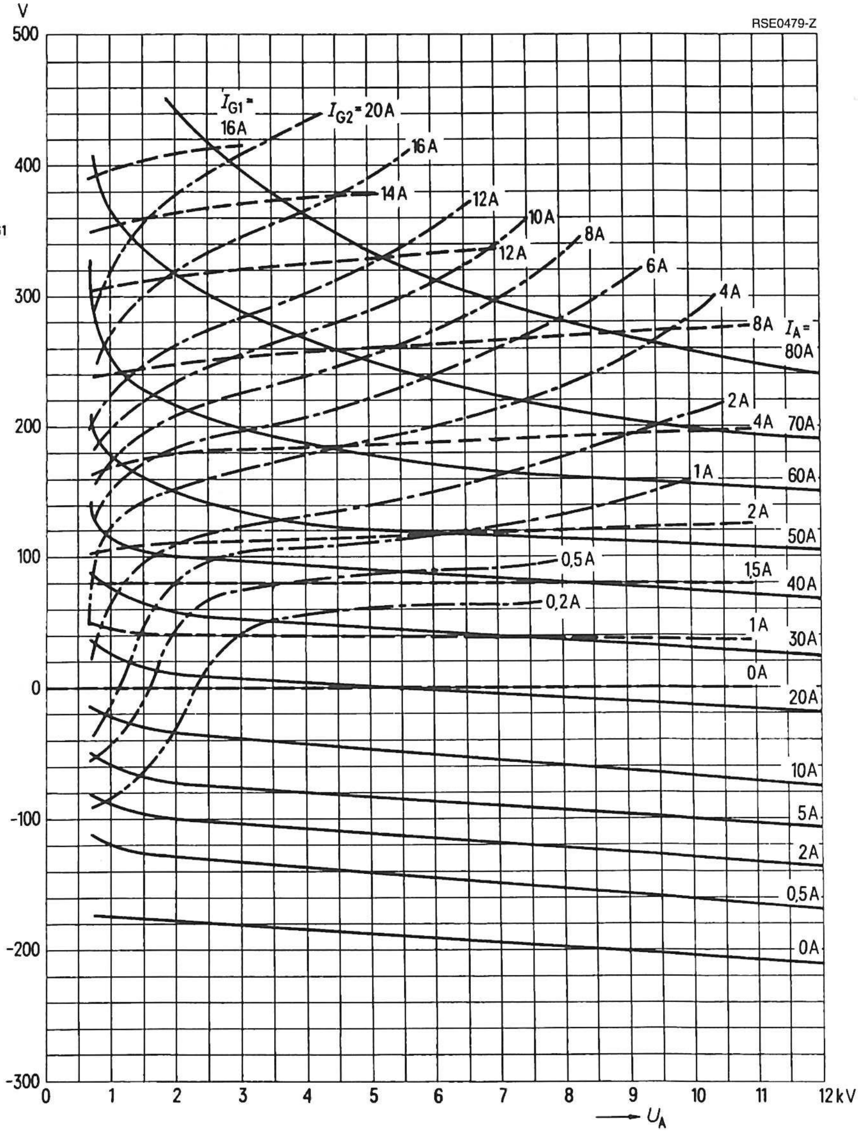
Cooling water diagram



t_1 = 35 °C

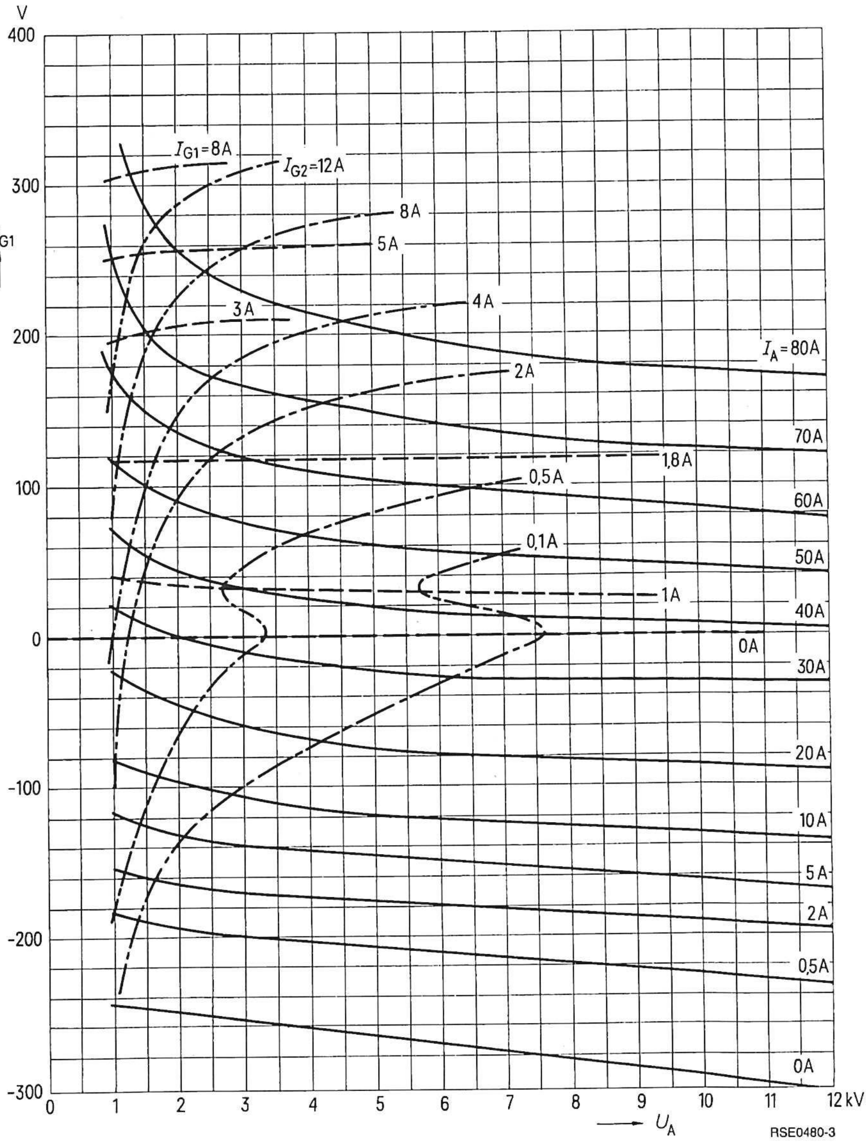
VX

$U_{G1} = f(U_A)$ Parameter = I_A ————————
$U_{G2} = 800$ V Parameter = I_{G2} —·—·—·—·—
Parameter = I_{G1} — — — — — —



$U_{G1} = f(U_A)$
$U_{G2} = 1200$ V

Parameter = I_A ————
Parameter = I_{G2} —·—·—·—
Parameter = I_{G1} — — — —

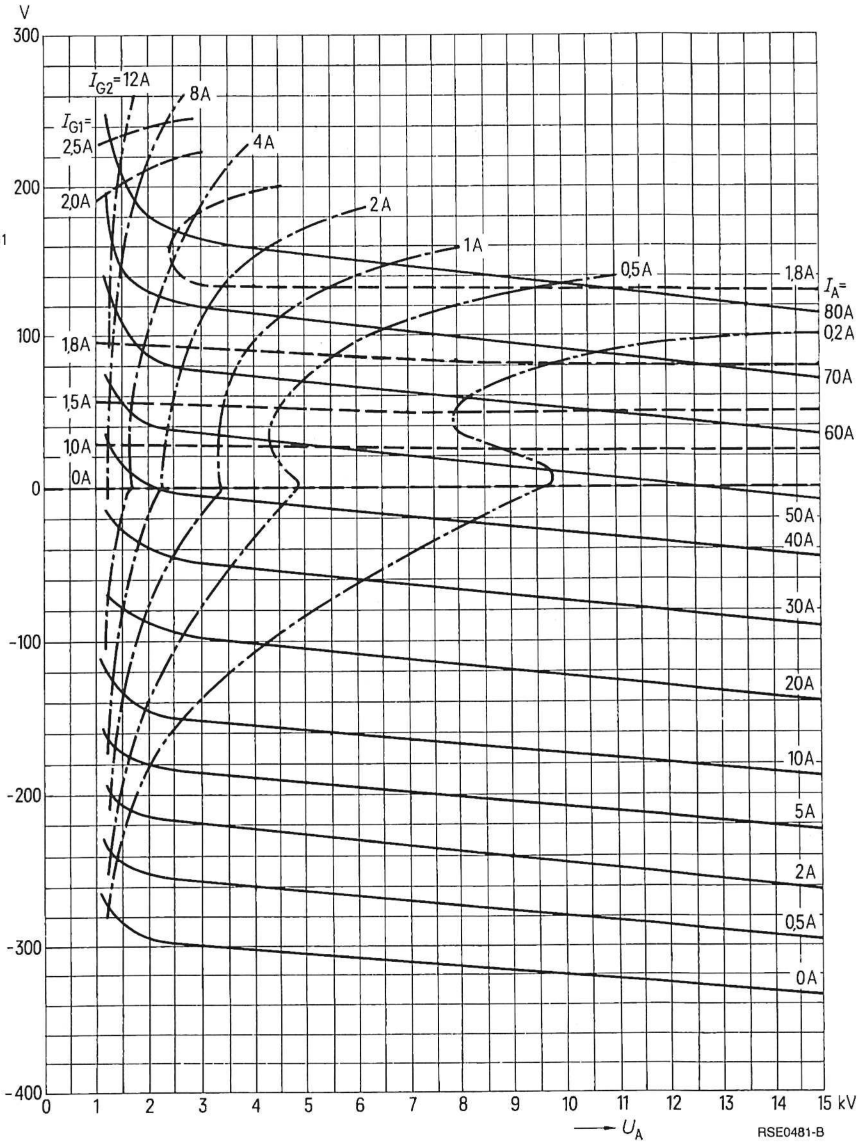


VX

$U_{G1} = f(U_A)$ Parameter = I_A ————————

U_{G2} = 1500 V Parameter = I_{G2} —·—·—·—·—

Parameter = I_{G1} — — — — — — —

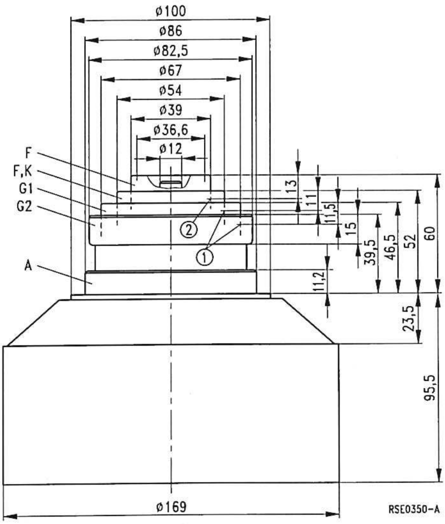


Coaxial metal-ceramic tetrode, forced-air-cooled or vapor-condensation-cooled, for frequencies up to 1000 MHz, particularly suitable for TV transmitters, band IV/V.

Forced-air-cooled version

RS 1092 L (TH 382)

Ordering code Q51-X1092



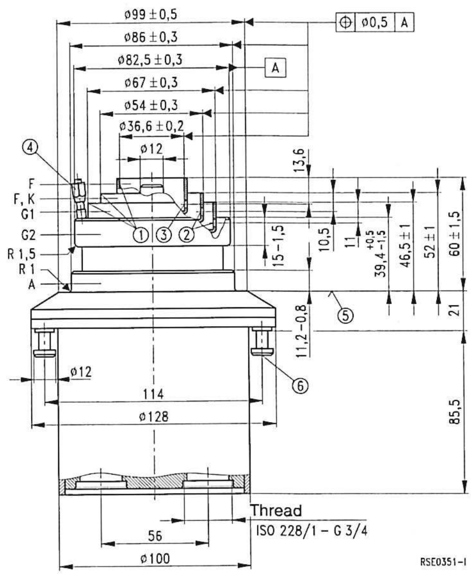
① 24 tapholes Ø 3
② 18 tapholes Ø 3

Approx. weight 7,2 kg

Vapor-condensation-cooled version

RS 1092 SK (TH 582)

Ordering code Q53-X1092



① R 0,5
② 24 tapholes Ø 3
③ 18 tapholes Ø 3
④ G2 cooling water connector
⑤ Tube support
⑥ Connection for tube handle

Approx. 5 kg

Heating

Heater voltage	U_F	3,9	V 1)
Heater current	I_F	≈ 134 / 2)	A
Heating: direct			
Cathode: thoriated tungsten			

Characteristics

Emission current at $U_A = U_{G2} = U_{G1} = 300$ V	I_{em}	40	A
Amplification factor of screen grid at $U_A = 2$ kV, $U_{G2} = 500$ to 800 V, $I_A = 3$ A	μ_{g2g1}	6,0	
Transconductance at $U_A = 2$ kV, $U_{G2} = 800$ V, $I_A = 2$ to 4 A	s	70	mA/V

Capacitances

Cathode/control grid	c_{kg1}	≈ 65	pF
Cathode/screen grid	c_{kg2}	≈ 3,30	pF
Cathode/anode	c_{ka}	≈ 0,07	pF 3)
Control grid/screen grid	c_{g1g2}	≈ 100	pF
Control grid/anode	c_{g1a}	≈ 0,39	pF 3)
Screen grid/anode	c_{g2a}	≈ 17,2	pF 4)

Accessories

RS 1092 L

		Ordering code
Cavity band IV/V	TK8241	upon request

RS 1092 SK

Gasket	RöZub110	upon request

1) The heater voltage will be determined by the tube manufacturer for each individual application taking into account the respective operating conditions. The heater data specified above are guideline values.
2) For RS 1092 SK ≈ 138 A.
3) Measured by a Ø 50 cm screening plate in the screen-grid terminal plane.
4) Measured by a Ø 50 cm screening plate in the anode ceramic plane: $c_{g2a} = 14{,}0$ pF.

TV vision transmitter, grounded control-grid screen-grid circuit, negative modulation, standard G

Maximum ratings

Frequency		f	1000	MHz
Anode voltage (dc)	(RS 1092 L)	U_A	6,5	kV
Anode voltage (dc)	(RS 1092 SK)	U_A	7,5	kV
Screen grid voltage (dc)	(RS 1092 L)	U_{G2}	800	V
Screen grid voltage (dc)	(RS 1092 SK)	U_{G2}	900	V
Control grid voltage (dc)		U_{G1}	– 200	V
Cathode current (dc)	(RS 1092 L)	I_K	4,5	A
Cathode current (dc)	(RS 1092 SK)	I_K	5,5	A
Peak cathode current		$I_{K\,M}$	22	A
Anode dissipation	(RS 1092 L)	P_A	12,5	kW
Anode dissipation	(RS 1092 SK)	P_A	25	kW
Screen grid dissipation		P_{G2}	120	W
Control grid dissipation		P_{G1}	50	W

Operating characteristics

		1)		
Frequency	f	800	800	MHz
Bandwidth (1 dB)	B	12	12	MHz
Output power, sync level	$P_{2\,SY}$	22	11	kW 2)
Gain	V_p	16	15	dB
Anode voltage (dc)	U_A	7,0	5,5	kV
Screen grid voltage (dc)	U_{G2}	800	600	V
Zero-signal anode current (dc)	$I_{A\,0}$	1,6	1,2	A 3) 4)
Anode current (dc), black level	$I_{A\,SW}$	4,7	3,3	A
Screen grid current (dc), black level	$I_{G2\,SW}$	80	30	mA
Control grid current (dc), black level	$I_{G1\,SW}$	20	5,0	mA

1) Only for RS 1092 SK.
2) At cavity output.
3) For RS 1092 SK: Set with U_{G1} approx. – 110 V.
4) For RS 1092 L: Set with U_{G1} approx. – 100 V.

Amplifier for TV transmitters with common vision and sound carrier transmission, grounded control-grid screen-grid circuit, vision-to-sound ratio 10:1, standard G

Maximum ratings

Frequency		f	1000	MHz
Anode voltage (dc)	(RS 1092 L)	U_A	6,5	kV
Anode voltage (dc)	(RS 1092 SK)	U_A	7,5	kV
Screen grid voltage (dc)	(RS 1092 L)	U_{G2}	800	V
Screen grid voltage (dc)	(RS 1092 SK)	U_{G2}	900	V
Control grid voltage (dc)		U_{G1}	– 200	V
Cathode current (dc)	(RS 1092 L)	I_K	4,5	A
Cathode current (dc)	(RS 1092 SK)	I_K	5,5	A
Peak cathode current		$I_{K\,M}$	22	A
Anode dissipation	(RS 1092 L)	P_A	12,5	kW
Anode dissipation	(RS 1092 SK)	P_A	25	kW
Screen grid dissipation		P_{G2}	120	W
Control grid dissipation		P_{G1}	50	W

Operating characteristics

		1)		
Frequency	f	800	800	MHz
Bandwidth (1 dB)	B	12	12	MHz
Output power, sync level	$P_{2\,SY}$	10,5/1,05	5,25/0,525	kW 2)
Gain	V_p	15	15	dB
3-tone intermodulation ratio	a_{IM3}	48	52	dB
Anode voltage (dc)	U_A	6,0	5,5	kV
Screen grid voltage (dc)	U_{G2}	600	600	V
Zero-signal anode current (dc)	$I_{A\,0}$	1,0	1,2	A 3) 4)
Anode current (dc), black level	$I_{A\,SW}$	3,3	2,6	A
Screen grid current (dc), black level	$I_{G2\,SW}$	50	30	mA
Control grid current (dc), black level	$I_{G1\,SW}$	30	10	mA

1) Only for RS 1092 SK.
2) At cavity output.
3) For RS 1092 SK: Set with U_{G1} approx. – 110 V.
4) For RS 1092 L: Set with U_{G1} approx. – 100 V.

Tube mounting

Axis vertical, anode up or down.

Spring contact rings are suitable connectors for cathode, control grid, screen grid and anode. The spring tension must be dimensioned such that the required power for inserting and withdrawing the tube remains below 150 N. Recommended pull-off power per spring contact ring is approx. 20 N.

Maximum tube surface temperature

The temperature of the electrode terminals and ceramic insulators must not exceed 300 °C (RS 1092 SK: 220 °C). For keeping below this maximum temperature an air flow is required to cool the terminal rings. For this purpose the terminal contacts must be designed for providing a uniform cooling effect.

Forced-air cooling (RS 1092 L)

The minimum air flow rate required for maximum anode dissipation is given in the cooling air diagram, valid for 25 °C inlet temperature at 1 bar air pressure (sea level). The cooling air must be supplied from the electrode terminal side. For detailed information on forced-air cooling refer to "Explanations on Technical Data".

Vapor condensation cooling (RS 1092 SK)

The cooling water diagram gives the minimum water flow rate (distilled or deionized water) for maximum anode dissipation, as well as pressure drop and water outlet temperature at 75 °C water inlet temperature. The diagram applies to a hermetically sealed cooling system with 1,5 bar overpressure at the tube's cooling water outlet and with a maximum permissible water outlet temperature of 100 °C.

Operation with open cooling cycle (without overpressure) is also possible if the maximum outlet temperature remains below 70 °C (sea level, air pressure $\approx$ 1 bar) with lower inlet temperature and, if required, increased water flow rate.

Automatic heating power regulation

Recommendations for automatic heating power stabilization are contained in the instruction "UHF TV Tetrodes, Heating Power Adjustment", which is supplied upon request.

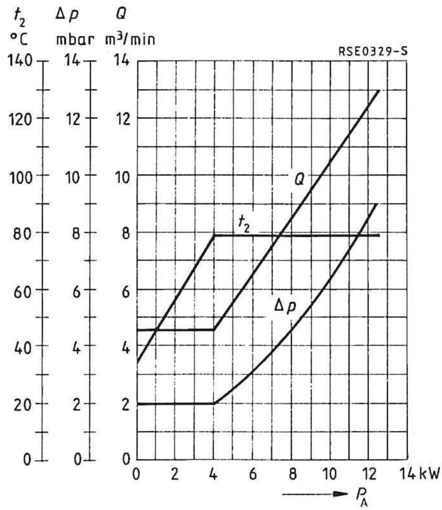
Safety precautions

The section "Safety precautions" under "Explanations on Technical Data" describes how the tube is to be protected against damage due to electric overload or insufficient cooling. A copper wire with Ø 0,18 mm should be used to test the anode overcurrent trip circuit.

Transmitter off-periods

Frequent switching of the heating reduces lifetime. So the heating (and cooling) should be left on during transmitter off-periods of up to two hours. Continuous heating with reduced power (black heating) should be provided for longer off-periods. Refer to "Explanations on Technical Data".

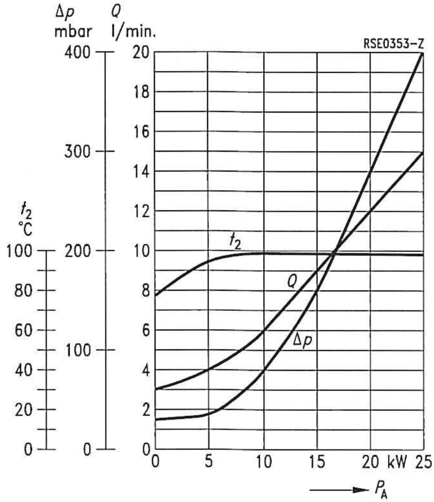
Cooling air diagram (RS 1092 L)



The cooling air is supplied from the electrode terminal side.

Air pressure = 1 bar
t_1 = 25 °C

Cooling water diagram (RS 1092 SK)

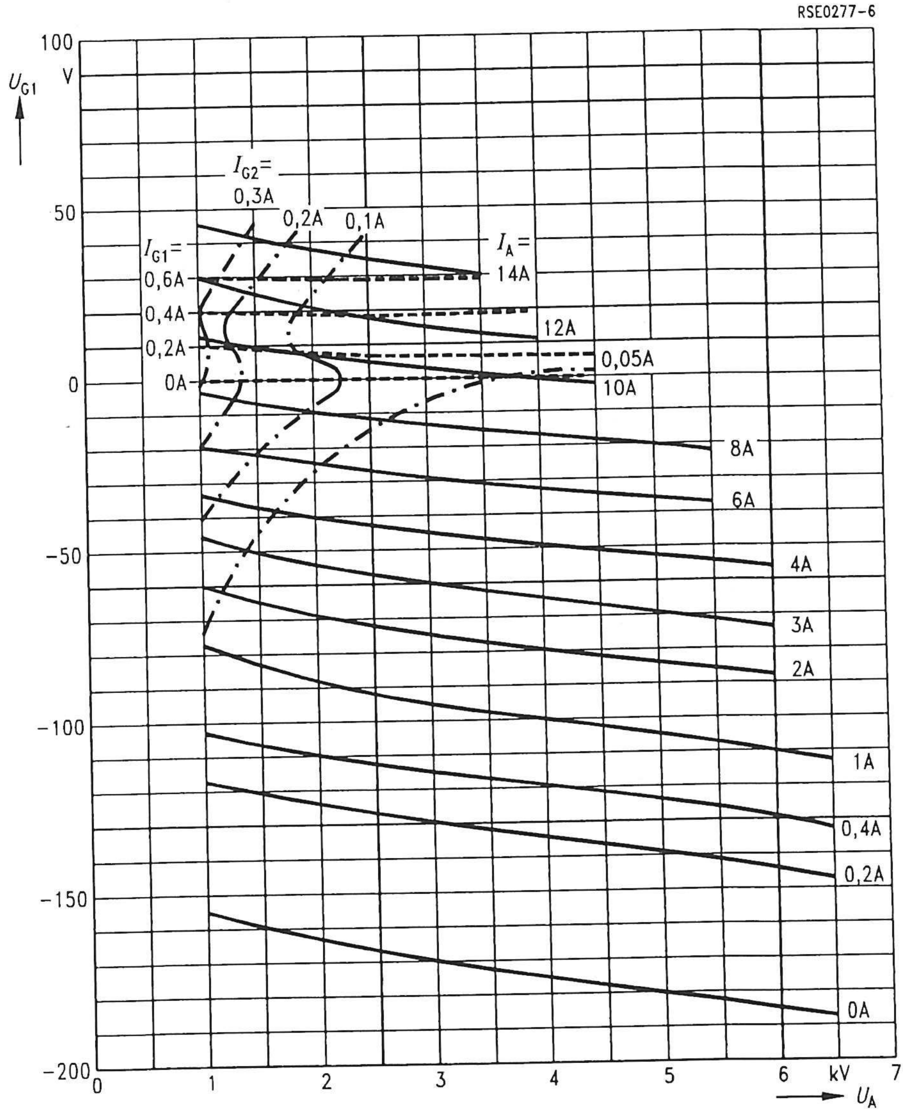


Closed cooling cycle with distilled water.

Overpressure = 1,5 bar
t_1 = 75 °C

$U_{G1} = f(U_A)$
$U_{G2} = 600$ V

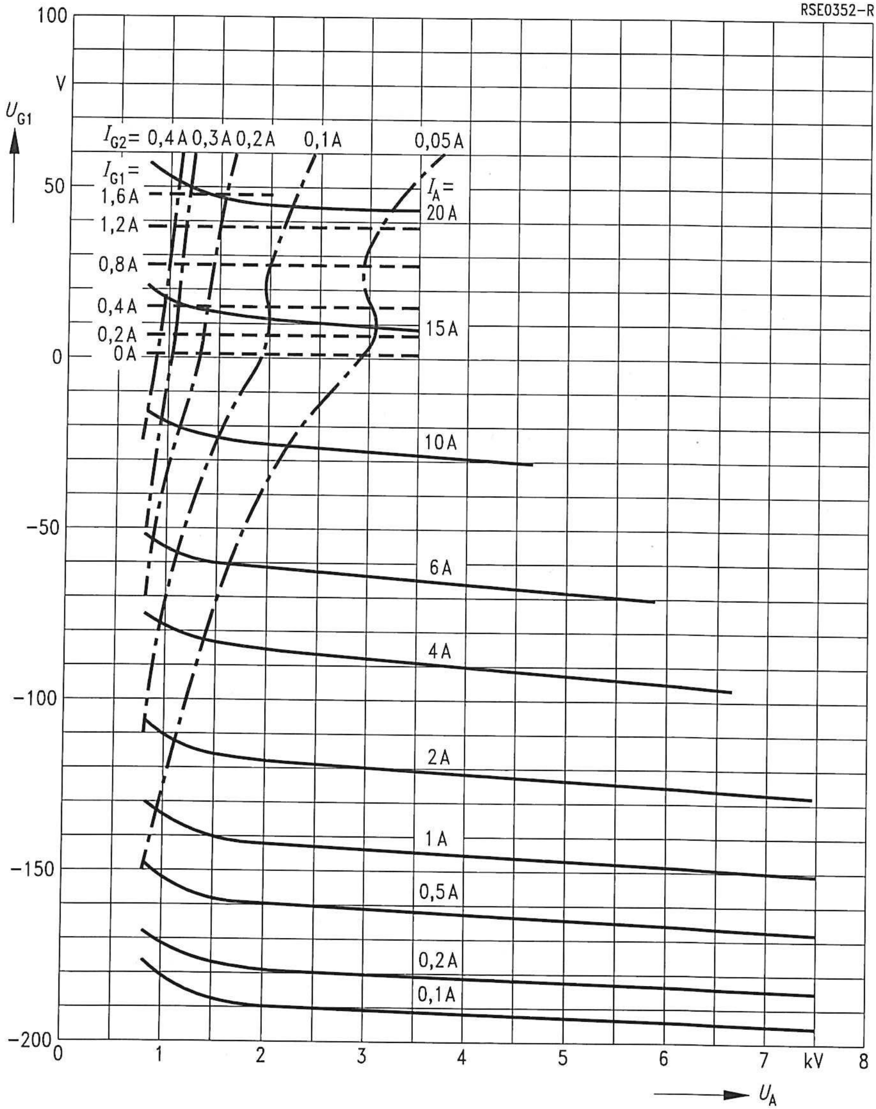
Parameter = I_A ————————
Parameter = I_{G2} —·—·—·—·—
Parameter = I_{G1} — — — — — —



VX

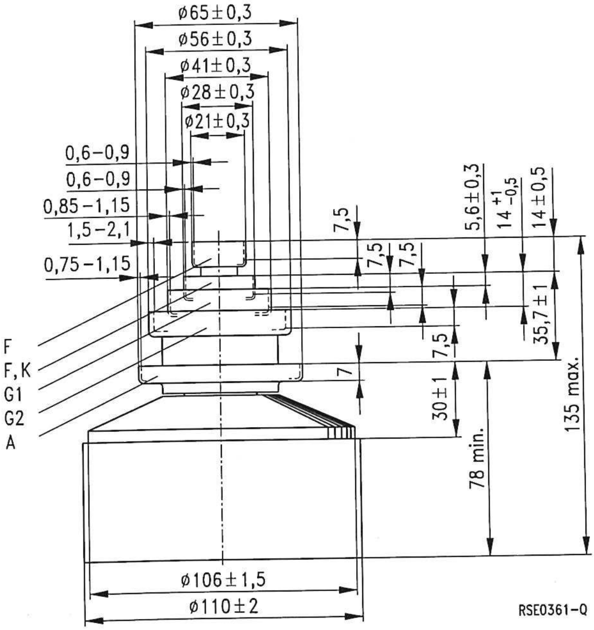
$U_{G1} = f(U_A)$
$U_{G2} = 800$ V

Parameter = I_A ————————
Parameter = I_{G2} —·—·—·—·—
Parameter = I_{G1} — — — — — —



Ordering code Q51-X1094

Coaxial metal-ceramic tetrode, forced-air-cooled, for frequencies up to 1000 MHz. The tube is especially suitable for TV transmitters and TV translators, band IV/V.



Dimensions in mm

Approx. weight 2,3 kg

Heating

Heater voltage	U_F	6,0	V [1]
Heater current	I_F	≈ 34	A
Heating: direct			
Cathode: thoriated tungsten			

Characteristics

Emission current at $U_A = U_{G2} = U_{G1} = 60$ V	I_{em}	6,0	A
Amplification factor of screen grid at $U_A = 1$ kV, $U_{G2} = 400$ to 600 V, $I_A = 1$ A	μ_{g2g1}	7,0	
Transconductance at $U_A = 1$ kV, $U_{G2} = 400$ V, $I_A = 1{,}5$ A	S	40	mA/V

Capacitances

Cathode/control grid	c_{kg1}	≈ 40	pF
Cathode/screen grid	c_{kg2}	≈ 1,4	pF
Cathode/anode	c_{ka}	≈ 0,02	pF [2]
Control grid/screen grid	c_{g1g2}	≈ 50	pF
Control grid/anode	c_{g1a}	≈ 0,18	pF [2]
Screen grid/anode	c_{g2a}	≈ 8,20	pF [3]

Accessories		Ordering code
Cavity band IV/V		upon request

1) The heater voltage will be determined by the tube manufacturer for each individual application taking into account the respective operating conditions. The heater data specified above are guideline values.
2) Measured by a Ø 50 cm screening plate in the screen-grid terminal plane.
3) Measured by a Ø 50 cm screening plate in the anode ceramic plane.

Amplifier for TV transmitters and TV translators with common vision and sound carrier transmission, grounded control-grid screen-grid circuit, vision-to-sound ratio 10:1, negative modulation, standard G

Maximum ratings

Frequency	f	1000	MHz
Anode voltage (dc)	U_A	5,0	kV
Screen grid voltage (dc)	U_{G2}	650	V
Control grid voltage (dc)	U_{G1}	– 200	V
Cathode current (dc)	I_K	2,0	A
Peak cathode current	$I_{K\,M}$	6,0	A
Anode dissipation	P_A	4,5	kW
Screen grid dissipation	P_{G2}	25	W
Control grid dissipation	P_{G1}	5,0	W

Operating characteristics

Frequency	f	800	MHz
Bandwidth (1 dB)	B	10	MHz
Output power, sync level	$P_{2\,SY}$	1,10	kW [1]
Gain	V_p	15,5	dB
3-tone intermodulation ratio	a_{IM3}	≥ 52	dB
Anode voltage (dc)	U_A	4,0	kV
Screen grid voltage (dc)	U_{G2}	400	V
Zero-signal anode current (dc)	$I_{A\,0}$	0,5	A [2]
Anode current (dc), black level	$I_{A\,SW}$	0,8	A
Screen grid current (dc), black level	$I_{G2\,SW}$	5,0	mA
Control grid current (dc), black level	$I_{G1\,SW}$	< 2	mA

1) At cavity output.
2) Set with U_{G1} approx. – 48 V.

TV vision transmitter,
grounded control-grid screen-grid circuit, negative modulation, standard G

Maximum ratings

Frequency	f	1000	MHz
Anode voltage (dc)	U_A	5,0	kV
Screen grid voltage (dc)	U_{G2}	650	V
Control grid voltage (dc)	U_{G1}	– 200	V
Cathode current (dc)	I_K	2,0	A
Peak cathode current	$I_{K\,M}$	6,0	A
Anode dissipation	P_A	4,5	kW
Screen grid dissipation	P_{G2}	25	W
Control grid dissipation	P_{G1}	5,0	W

Operating characteristics

Frequency	f	800	MHz
Bandwidth (1 dB)	B	10	MHz
Output power, sync level	$P_{2\,SY}$	2,20	kW 1)
Gain	V_p	15,5	dB
Anode voltage (dc)	U_A	4,0	kV
Screen grid voltage (dc)	U_{G2}	400	V
Zero-signal anode current (dc)	$I_{A\,0}$	0,5	A 2)
Anode current (dc), black level	$I_{A\,SW}$	1,5	A
Screen grid current (dc), black level	$I_{G2\,SW}$	5,0	mA
Control grid current (dc), black level	$I_{G1\,SW}$	< 2	mA

1) At cavity output.
2) Set with U_{G1} approx. – 48 V.

Tube mounting

Axis vertical, anode up or down.

Maximum tube surface temperature

The temperature of the electrode terminals and ceramic insulators must not exceed 250 °C. For keeping below this maximum temperature an air flow is required to cool the terminal rings. For this purpose the terminal contacts must be designed for providing a uniform cooling effect.

Forced-air cooling

The minimum air flow rate required for maximum anode dissipation is given in the cooling air diagram, valid for 45 °C inlet temperature at 1 bar air pressure (sea level). The cooling air must be supplied from the electrode terminal side. For detailed information on forced-air cooling refer to "Explanations on Technical Data".

Automatic heating power regulation

Recommendations for automatic heating power stabilization are contained in the instruction "UHF TV Tetrodes, Heating Power Adjustment", which is supplied on request.

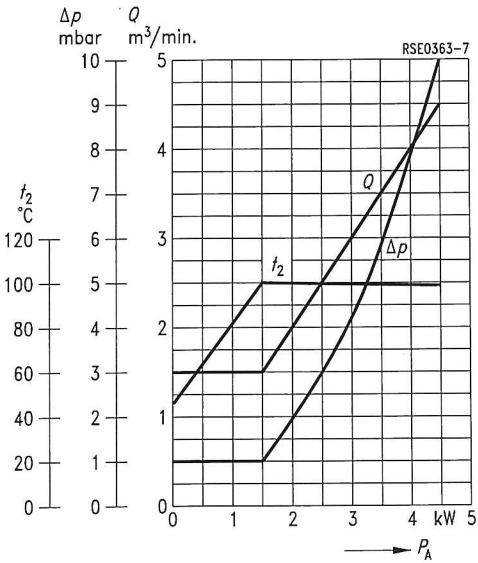
Safety precautions

The section "Safety precautions" under "Explanations on Technical Data" describes how the tube is to be protected against damage due to electric overload or insufficient cooling.

Transmitter off-periods

Frequent switching of the heating reduces lifetime. So the heating (and cooling) should be left on during transmitter off-periods of up to two hours. Continuous heating with reduced power (black heating) should be provided for longer off-periods. Refer to "Explanations on Technical Data".

Cooling air diagram



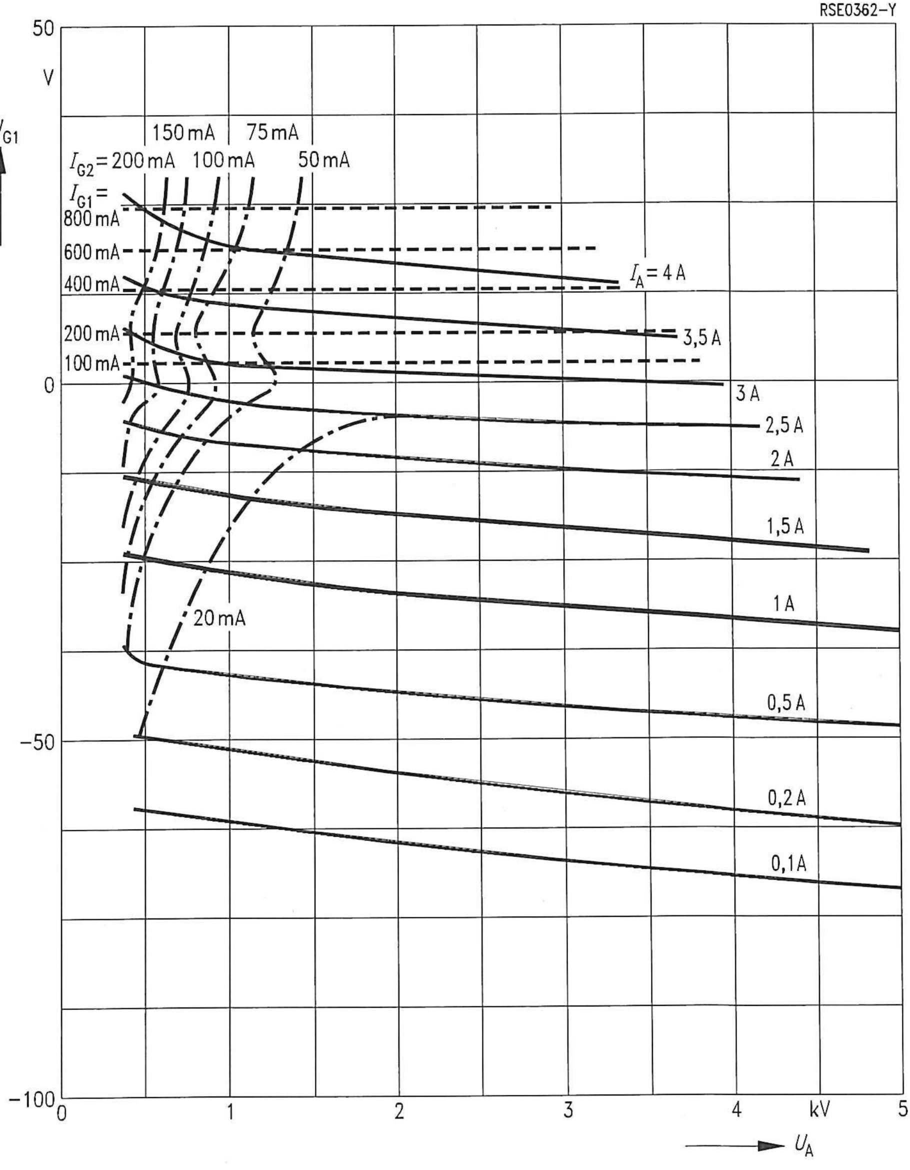
The cooling air is supplied from the electrode terminal side.

Air pressure = 1 bar

t_1 = 25 °C

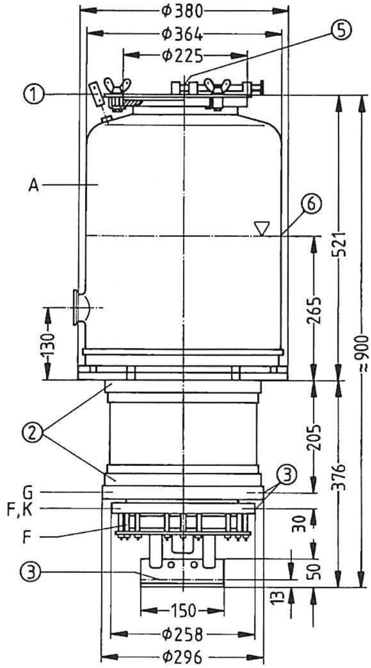
$U_{G1} = f(U_A)$
$U_{G2} = 400$ V

Parameter = I_A ————————
Parameter = I_{G2} —·—·—·—·—
Parameter = I_{G1} — — — — — —

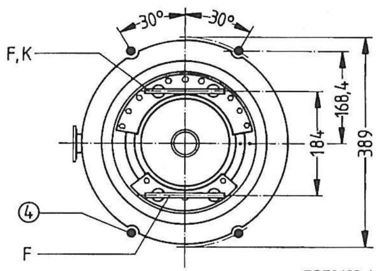


Ordering code Q53-X1828

Coaxial metal-ceramic triode, vapor-cooled with integrated boiler, suitable for broadcast transmitters up to 350 kW medium and short wave.



Bottom view



Dimensions in mm

① Connection of tube fuse RöSich828
② Do not use as terminal
③ Contact surface
④ Slide rods in the transmitter, 20 mm dia.
⑤ Crane suspension
⑥ Max. water level

Approx. weight 123 kg

Heating

Heater voltage	U_F	10	V
Heater current	I_F	≈ 980	A
Permissible starting current	$I_{F M}$	≤ 2000	A
Heating: direct			
Cathode: thoriated tungsten			

Characteristics

Emission current at $U_A = U_G = 900$ V	I_{em}	500	A
Amplification factor at $U_A = 8$ to 12 kV, $I_A = 10$ A	μ	100	
Transconductance at $U_A = 8$ kV, $I_A = 10$ A	s	250	mA/V

Capacitances

Cathode/grid	c_{kg}	≈ 600	pF
Cathode/anode	c_{ka}	≈ 4,0	pF [1])
Grid/anode	c_{ga}	≈ 225	pF

Accessories		Ordering code
Cathode terminal	RöKat828	Q1001-X26
Grid terminal	RöGit491	Q1001-X19
Pressure piece for water inlet	RöZub101	Q1001-X110
Locking piece for water inlet	RöZub102	Q1001-X111
Gasket ring for water inlet	RöZub103	C65055-A670-C503
Gasket ring for vapor inlet	RöZub104	C65055-A670-C504
Tube fuse	RöSich828	C65055-A870-A98
LL electrolytic target	RöEl30	Q1001-X128
Gasket ring for boiler		C65051-A410-C538

1) Measured by means of a 60 cm diameter screening plate in the grid terminal plane.

Anode voltage modulation, 50 % modulated driver stage

Maximum ratings

Frequency	f	30	MHz
Anode voltage (dc)	U_A	12	kV
Grid voltage (dc)	U_G	– 800	V
Cathode current (dc)	I_K	70	A
Peak cathode current	$I_{K\,M}$	480	A
Anode dissipation	P_A	250	kW
Grid dissipation	P_G	7,0	kW

Operating characteristics

		I	I	II	
Frequency	f	1,6	1,6	≤ 30	MHz
Carrier power	P_{trg}	370	320	370+34 [2])	kW [1])
Anode voltage (dc)	U_A	11,5	11	11,5	kV
Grid bias (dc), fixed	$U_{G\,fix}$	– 140	– 140	– 140	V
Grid resistance	R_G	38	40	38	Ω
Peak grid voltage (ac)	$U_{g\,m}$	1000	950	1000	V
Anode current (dc)	I_A	40	36	40	A
Grid current (dc)	I_G	11	10	11	A
Anode input power	$P_{B\,A}$	460	395	460	kW
Drive power	P_1	10	8,5	10+34 [2])	kW [1])
Anode dissipation	P_A	90	75	90	kW [3])
Grid dissipation	P_G	3,9	3,1	3,9	kW
Efficiency	η	81	81	81	%
Anode load resistance	R_A	160	165	175	Ω
Modulation factor	m	100	100	100	%
Modulation power	P_{mod}	230	198	230	kW
Grid dissipation at modulation	$P_{G\,mod}$	5	3,7	5	kW [4])
Peak grid voltage (ac)	$U_{g\,m}$	1500	1420	1500	V [5])
Grid current (dc)	I_G	18	15	18	A [5])
Drive power	P_1	25	19	25+103 [2])	kW [1]) [5])

I Grounded cathode circuit
II Grounded grid circuit

1) Circuit losses are not included.
2) Power transition of the grounded grid circuit.
3) Even during modulation the indicated maximum ratings must not be exceeded. It has to be observed that the plate dissipation will increase to about 1,5 times the power dissipation stated for the carrier value during 100 % modulation.
4) Average grid dissipation at 100 % modulation.
5) Maximum values at peak modulation.

Tube mounting

Axis vertical, anode up.

For connection of the tube use the terminals under "Accessories".

To insert the tube in the fixed tube socket, the slide rods of 20 mm diameter which are attached to the anode flange support bearing must be used as indicated on the dimensional drawing. It is thereby ensured that the tube slips centrically into the grid connection ring, and the contact blades for the heater current come into the right position to the clamping jaws incorporated in the transmitter.

In case of dismounting the tube, care must be taken that the water is removed from the interior of the vapor-cooled anode. For this purpose the hose of the emptying pump must be led into the tube through the vapor outlet and down into the visibly located central pipe.

Maximum tube surface temperature

The temperature of the metal-ceramic seals must not exceed 200 °C at any point. The maximum permissible difference in temperature at the circumference of the ceramic is 50 °C and in the axial direction 80 °C. The temperature gradient must not exceed 10 °C/cm. These limits can usually be observed by leading the air stream, which is required for the cooling of the tube terminals, along the anode ceramic.

In order to keep the temperature limit of 200 °C at the metal-ceramic seals, additional cooling of the tube terminals is necessary. For this purpose an air stream of at least 5 m^3/min at a normal air pressure of 1 bar and 20 °C ambient temperature is conducted through the tube socket. At higher sea levels and ambient temperature the minimum air flow rate must be increased proportionally.

After disconnecting the heater voltage, the tube terminals need an aftercooling time of 10 minutes. Thus the heat flow coming from the tube interior cannot cause impermissible heating up of the terminals and of the spring finger contacts of the connection rings.

The aftercooling time can be reduced to 5 minutes if the cooling air rate for ventilating the tube socket is increased to 7 m^3/min. The temperature of the curved part of the copper-beryllium spring-finger contacts in the connecting rings must not exceed 140 °C.

Vapor cooling

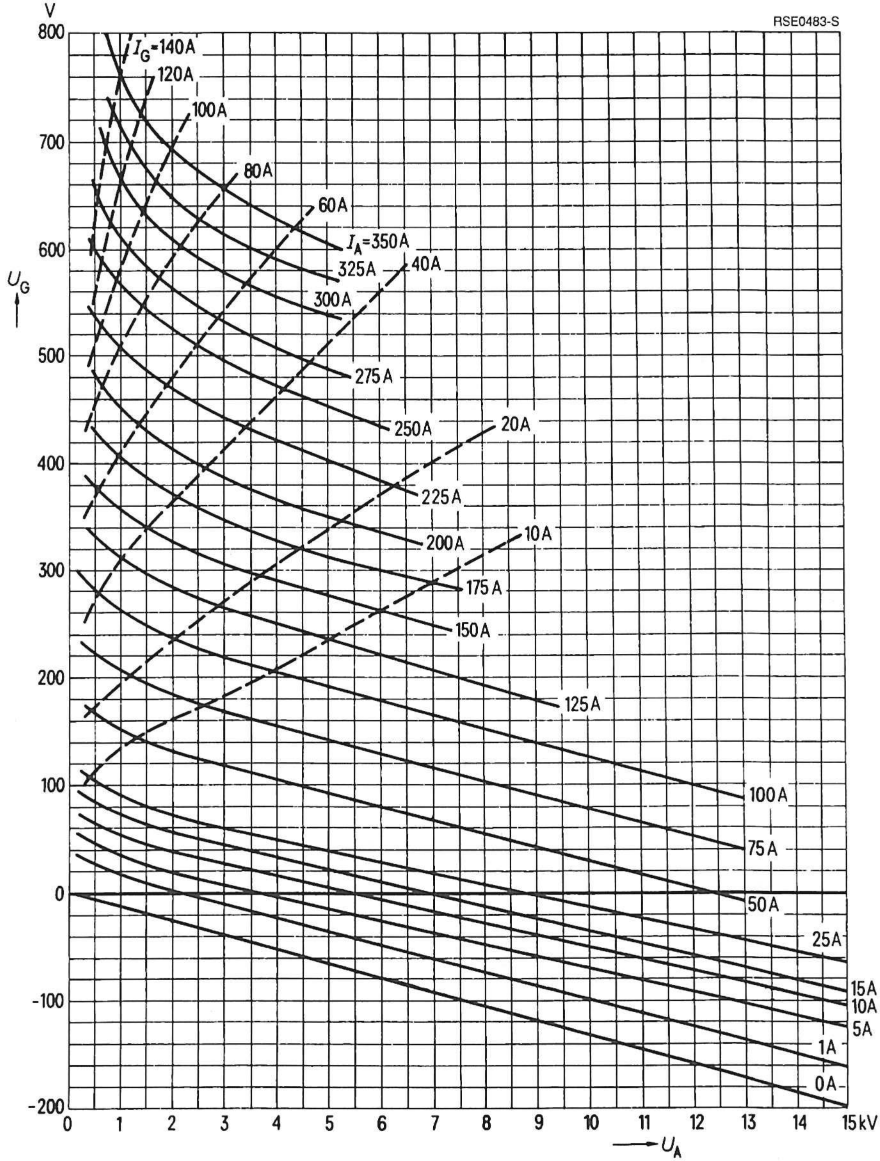
Cooling data for maximum anode dissipation	$P_{A\,max}$ = 250 kW
Total power to be dissipated by the cooling system ($P_A + P_G + 0{,}8\ P_F$)	265 kW
Equivalent thermal output	15900 kJ/min (3800 kcal/min)
Flow rate of returning water	
at returning water temperature of 20 °C	approx. 6,2 l/min
at returning water temperature of 90 °C	approx. 6,9 l/min
Volume of generated vapor	
at returning water temperature of 20 °C	approx. 10,4 m^3/min
at returning water temperature of 90 °C	approx. 11,7 m^3/min

Detailed information on vapor cooling upon request. Please observe the instructions on vapor cooling given under “Explanations on Technical Data”.

Safety precautions

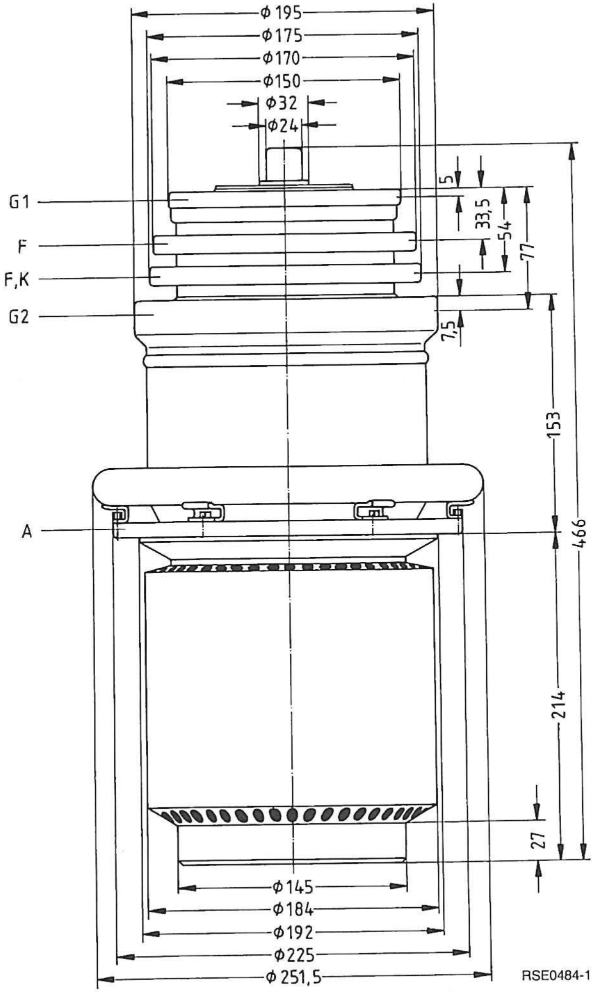
The section “Safety precautions” under “Explanations on Technical Data” describes how the tube is to be protected against damage due to electric overload or insufficient cooling. A copper wire with 0,25 mm diameter should be used to test the anode overcurrent trip circuit.

$U_G = f(U_A)$ Parameter = I_A ———— Parameter = I_G – – – – –



Ordering code Q53-X1896

Linear metal-ceramic-glass tetrode with coaxial electrode lead-throughs, vapor-cooled, suitable for single-sideband transmitter of up to 100 kW or 55 kW with grid-current free modulation.



Dimensions in mm

Approx. weight 30 kg

Heating

Heater voltage	U_F	11	V
Heater current	I_F	≈ 175	A
Permissible starting current	$I_{F M}$	≤ 240	A
Heating: direct			
Cathode: thoriated tungsten			

Characteristics

Emission current at $U_A = U_{G2} = U_{G1} = 550$ V	I_{em}	55	A
Amplification factor of screen grid at $U_A = 13$ kV, $U_{G2} = 1{,}5$ to 2 kV, $I_A = 3$ A	μ_{g2g1}	5,5	
Transconductance at $U_A = 13$ kV, $U_{G2} = 2$ kV, $I_A = 3$ A	s	40	mA/V

Capacitances

Cathode/control grid	c_{kg1}	≈ 195	pF
Cathode/screen grid	c_{kg2}	≈ 70	pF
Cathode/anode	c_{ka}	≈ 0,45	pF [1])
Control grid/screen grid	c_{g1g2}	≈ 145	pF
Control grid/anode	c_{g1a}	≈ 2,5	pF [1])
Screen grid/anode	c_{g2a}	≈ 70	pF

Accessories		Ordering code
Connector for heater and cathode	RöKat896	Q1001-X5
Connector for heater	RöKat897	Q1001-X6
Control grid terminal	RöGit896	Q1001-X18
Screen grid terminal	RöGit897	Q1001-X17
Handle	RöZub896	Q1001-X105
Boiler 100 kW	RöKüV896	Q1001-X47
Gasket at vapor outlet	RöKüV201Zub8	Q81-X1678
Insulating pipe at vapor outlet	RöKüV896Zub3	Q81-X1660
Insulating pipe at water inlet	RöKüV896Zub4	Q81-X1662
Union at water inlet	RöKüV896Zub7	C65055-A664-A42
LL electrolytic target	RöEl41	C65055-A667-A41
Gasket ring for tube flange		C65051-A411-C552
Anode terminal with contact springs for 100 kW boiler	C65055-A620-B120	Q1001-X22
Gasket ring for water supply line	C65055-A620-C545	Q1001-X77
Gasket ring for vapor outlet	C65055-A620-C543	Q1001-X78

1) Measured by means of a 50 cm diameter screening plate in the screen grid terminal plane.

VX

RF linear amplifier, single-sideband modulation, grounded cathode circuit

Maximum ratings

Frequency	f	30	MHz
Anode voltage (dc)	U_A	15	kV
Screen grid voltage (dc)	U_{G2}	2400	V
Control grid voltage (dc)	U_{G1}	– 1000	V
Cathode current (dc)	I_K	18	A
Peak cathode current	I_{KM}	55	A
Anode dissipation	P_A	100	kW
Screen grid dissipation	P_{G2}	1,8	kW
Control grid dissipation	P_{G1}	500	W

Operating characteristics

	I	II	III	I	II	III	
P_2	0	110	55	0	60	30	kW [1])
U_A	13,5	13,5	13,5	13	13	13	kV
U_{G2}	2000	2000	2000	2200	2200	2200	V
U_{G1}	– 375	– 375	– 375	– 430	– 430	– 430	V
$U_{g1\,m}$	0	620	620	0	375	375	V
I_A	3	14,2	9,5	2	7,5	5,1	A
I_{G2}	0	0,45	0,22	0	0,23	0,12	A
I_{G1}	0	0,30	0,15	0	–	–	A
P_{BA}	40,5	192	128	26	97,5	66	kW
P_1	0	168	84	0	–	–	W
P_A	40,5	82	73	26	37,5	36	kW
P_{G2}	0	0,9	0,44	0	0,51	0,26	W
P_{G1}	0	55	28	0	–	–	W
η	–	57,5	43	–	61,5	45,5	%
R_A	–	460	460	–	710	710	Ω

I No modulation
II 1-tone modulation
III 2-tone modulation

1) Circuit losses are not included.

Tube mounting

Axis vertical, anode down.

For connection of the tube use the terminals listed under “Accessories”.

Maximum tube surface temperature

The temperature of the glass-metal seals must not exceed 170 °C at any point. The maximum permissible temperature in the center of the glass bulb between screen grid and anode is 220 °C. The ceramic and the connecting points between metal and ceramic must not exceed 220 °C.

The maximum permissible temperature difference at the bulb circumference is 50 °C. The temperature gradient must not exceed 20 °C/cm. This requires additional cooling of the tube terminals by an adequately directed air flow of min. 2 m³/min. Care must be taken that grid and heater lead-throughs are in proper contact.

Vapor cooling

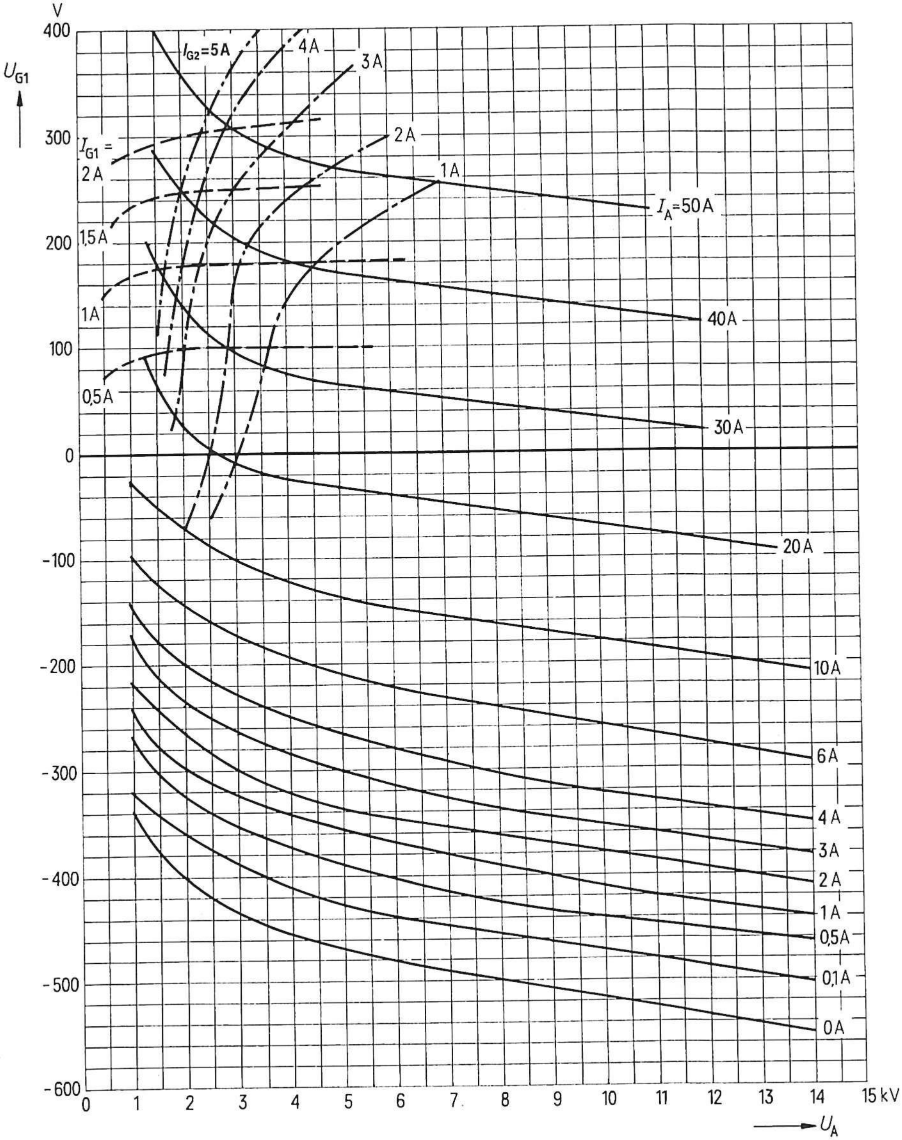
Cooling data for maximum anode dissipation	$P_{A\,max}$ = 100 kW
Total power to be dissipated by the cooling system ($P_A + P_{G2} + P_{G1} + 0{,}8\ P_F$)	103,8 kW
Equivalent thermal output	6170 kJ/min (1480 kcal/min)
Flow rate of returning water	
at returning water temperature of 20 °C	approx. 2,4 l/min
at returning water temperature of 90 °C	approx. 2,7 l/min
Volume of generated vapor	
at returning water temperature of 20 °C	approx. 4,0 m³/min
at returning water temperature of 90 °C	approx. 4,5 m³/min

Detailed information on vapor cooling upon request. Please observe the instructions on vapor cooling given under “Explanations on Technical Data”.

Safety precautions

The section “Safety precautions” under “Explanations on Technical Data” describes how the tube is to be protected against damage due to electric overload or insufficient cooling. A copper wire with 0,22 mm diameter is used to test the anode overcurrent trip circuit.

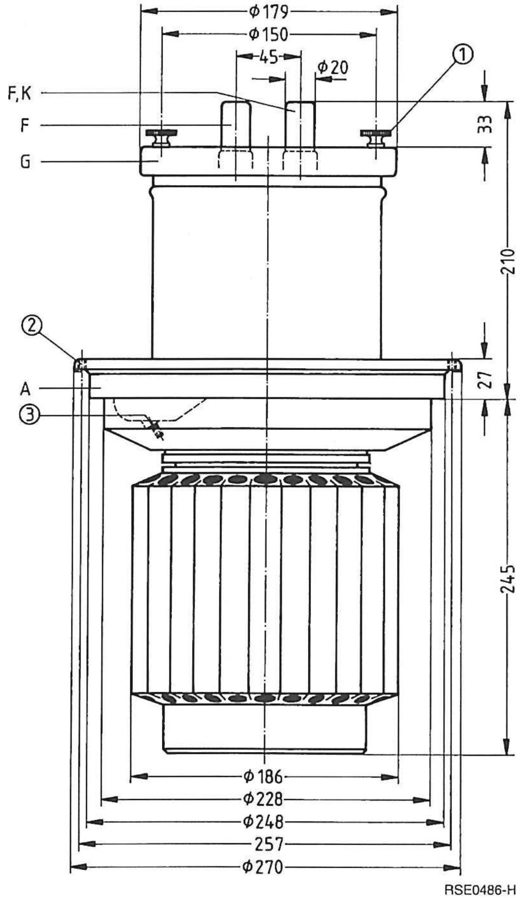
$U_{G1} = f(U_A)$ Parameter = I_A ————
$U_{G2} = 2000$ V Parameter = I_{G2} —·—·—·—
Parameter = I_{G1} — — — —



RSE0485-9

For frequencies up to 30 MHz Ordering code Q53-X2001

Vapor-cooled triode with coaxial grid lead-through, suitable for application as RF amplifier and modulator.



Dimensions in mm

① 4 tapholes M5 (4 × 90°)
② Taphole M6 for screw-in handle RöZub201K
③ Taphole M5 for tube fuse RöSich4

Approx. weight 34 kg

Heating

Heater voltage	U_F	18	V
Heater current	I_F	≈ 164	A
Heating: direct			
Cathode: thoriated tungsten			

Characteristics

Emission current at $U_A = U_G = 750$ V	I_{em}	125	A
Amplification factor at $U_A = 4$ to 10 kV, $I_A = 5$ A	μ	50	
Transconductance at $U_A = 4$ kV, $I_A = 5$ A	S	110	mA/V

Capacitances

Cathode/grid	c_{kg}	≈ 170	pF
Cathode/anode	c_{ka}	≈ 4,0	pF [1])
Grid/anode	c_{ga}	≈ 68	pF

Accessories

		Ordering code
Mounting instruction	RöMo14	
Mounting instruction	RöMo25	
Cathode connecting strip (2 for each tube)	RöKat41	Q81-X1141
Socket wrench for tube fuse	RöZub10	Q81-X2110
Handle	RöZub201K	Q81-X2151
Tube fuse	RöSich4	Q81-X1404
Pull switch for tube fuse	RöKt11	Q81-X1311
Boiler	RöKüV201	Q81-X1671
Union at water inlet	RöKüV41Zub7	Q81-X1647
Insulating pipe at vapor outlet	RöKüV201Zub3	Q81-X1673
Insulating pipe at water inlet	RöKüV201Zub4	Q81-X1675
Insulator	RöKüV201Zub5K	Q81-X1676
Gasket at vapor outlet	RöKüV201Zub8	Q81-X1678
Water level stabilizer with control electrodes	RöZubV4	Q81-X2105
LL electrolytic target	RöEl23	C65055-A667-A23
Gasket ring for boiler	RöN9355	C65051-A201-C531

1) Measured by means of a 40 cm × 40 cm screening plate in the grid terminal plane.

RF amplifier,
class B operation, grounded cathode circuit

Maximum ratings

Frequency	f	10	30	MHz
Anode voltage (dc)	U_A	16	12,5	kV
Grid voltage (dc)	U_G	– 1000	– 1000	V
Cathode current (dc)	I_K	30	30	A
Peak cathode current	$I_{K\,M}$	100	100	A
Anode dissipation	P_A	110	110	kW
Grid dissipation	P_G	2,0	2,0	kW

Operating characteristics

Frequency	f	≤ 10	≤ 10	≤ 30	≤ 30	MHz
Output power	P_2	220	150	140	100	kW [1])
Anode voltage (dc)	U_A	15	15	12	12	kV
Grid voltage (dc)	U_G	– 300	– 285	– 230	– 230	V
Peak grid voltage (ac)	$U_{g\,m}$	730	605	600	515	V
Zero signal anode current (dc)	$I_{A\,0}$	0,8	1,0	1,0	1,0	A
Anode current (dc)	I_A	21	13,7	16	11,5	A [2])
Grid current (dc)	I_G	3,32	2,2	2,9	1,95	A
Anode input power	$P_{B\,A}$	315	206	192	138	kW
Drive power	P_1	2,17	1,3	1,6	0,95	kW [1])
Anode dissipation	P_A	95	56	52	38	kW
Grid dissipation	P_G	1,17	0,65	0,95	0,5	kW
Efficiency	η	70	73	73	72,5	%
Anode load resistance	R_A	445	700	475	660	Ω

1) Circuit losses are not included.
2) Modulated anode current.

RF amplifier, class C operation, grounded cathode circuit

Maximum ratings

Frequency	f	10	30	MHz
Anode voltage (dc)	U_A	16	12,5	kV
Grid voltage (dc)	U_G	– 1000	– 1000	V
Cathode current (dc)	I_K	30	30	A
Peak cathode current	$I_{K\,M}$	100	100	A
Anode dissipation	P_A	110	110	kW
Grid dissipation	P_G	2,0	2,0	kW

Operating characteristics

Frequency	f	≤ 10	≤ 30	≤ 30	MHz
Output power	P_2	200	165	110	kW [1])
Anode voltage (dc)	U_A	14	12	10	kV
Grid voltage (dc)	U_G	– 650	– 600	– 500	V
Peak grid voltage (ac)	$U_{g\,m}$	1150	1100	925	V
Anode current (dc)	I_A	17,6	17,1	13,8	A
Grid current (dc)	I_G	3,8	4,0	3,4	A
Anode input power	$P_{B\,A}$	247	205	138	kW
Drive power	P_1	4,0	4,0	2,9	kW [1])
Anode dissipation	P_A	47	40	28	kW
Grid dissipation	P_G	1,55	1,6	1,2	kW
Efficiency	η	81	80,5	80	%
Anode load resistance	R_A	442	387	393	Ω

1) Circuit losses are not included.

Anode voltage modulation, constant RF grid ac voltage, grounded cathode circuit

Maximum ratings

Frequency	f	30	MHz
Anode voltage (dc)	U_A	11,5	kV
Grid voltage (dc)	U_G	– 1000	V
Cathode current (dc)	I_K	20	A
Peak cathode current	I_{KM}	125	A
Anode dissipation	P_A	110	kW
Grid dissipation	P_G	2,0	kW

Operating characteristics

Frequency	f	≤ 30	≤ 30	MHz
Carrier power	P_{trg}	100	66	kW 1)
Anode voltage (dc)	U_A	11	10	kV
Grid bias (dc), fixed	$U_{G\,fix}$	– 200	– 195	V
Grid resistance	R_G	70	80	Ω
Peak grid voltage (ac)	$U_{g\,m}$	960	785	V
Anode current (dc)	I_A	11,4	8,5	A
Grid current (dc)	I_G	4,7	3,2	A
Anode input power	P_{BA}	125	85	kW
Drive power	P_1	4,3	2,3	kW 1)
Anode dissipation	P_A	25	19	kW 2)
Grid dissipation	P_G	1800	850	W
Efficiency	η	80	77,5	%
Anode load resistance	R_A	600	765	Ω
Modulation factor	m	100	100	%
Modulation power	P_{mod}	62,5	42,5	kW
Grid current (dc)	I_G	4,8	4,0	A 3)
Drive power	P_1	4,2	3,0	kW 1) 3)
Grid current (dc)	I_G	3,7	2,6	A 4)
Drive power	P_1	3,4	1,9	kW 1) 4)

1) Circuit losses are not included.
2) Even during modulation the indicated maximum ratings must not be exceeded. It has to be observed that during 100 % modulation the plate dissipation increases to about 1,5 times the power dissipation stated for the carrier value.
3) Maximum values at $U_A = 0$ V.
4) Maximum values at peak modulation.

Anode voltage modulation,
50 % modulated driver stage, grounded cathode circuit

Maximum ratings

Frequency	f	30	MHz
Anode voltage (dc)	U_A	11,5	kV
Grid voltage (dc)	U_G	– 1000	V
Cathode current (dc)	I_K	20	A
Peak cathode current	$I_{K M}$	125	A
Anode dissipation	P_A	110	kW
Grid dissipation	P_G	2,0	kW

Operating characteristics

Frequency	f	≤ 30	MHz
Carrier power	P_{trg}	110	kW 1)
Anode voltage (dc)	U_A	11	kV
Grid bias (dc), fixed	$U_{G\ fix}$	– 200	V
Grid resistance	R_G	190	Ω
Peak grid voltage (ac)	$U_{g\ m}$	1200	V
Anode current (dc)	I_A	12	A
Grid current (dc)	I_G	3,1	A
Anode input power	$P_{B\ A}$	132	kW
Drive power	P_1	3,4	kW 1)
Anode dissipation	P_A	22	kW 2)
Grid dissipation	P_G	0,96	kW
Efficiency	η	83	%
Anode load resistance	R_A	500	Ω
Modulation factor	m	100	%
Modulation power	P_{mod}	66	kW
Grid dissipation at modulation	$P_{G\ mod}$	1,32	kW 3)
Peak grid voltage (ac)	$U_{g\ m}$	1800	V 4)
Grid current (dc)	I_G	5,1	A 4)
Drive power	P_1	8,7	kW 1) 4)

1) Circuit losses are not included.
2) Even during modulation the indicated maximum ratings must not be exceeded. It has to be observed that during 100 % modulation the plate dissipation increases to about 1,5 times the power dissipation stated for the carrier value.
3) Average value at m = 100 %.
4) Maximum values at peak modulation.

Anode voltage modulation, 50 % modulated driver stage, grounded grid circuit

Maximum ratings

Frequency	f	30	MHz
Anode voltage (dc)	U_A	11,5	kV
Grid voltage (dc)	U_G	– 1000	V
Cathode current (dc)	I_K	20	A
Peak cathode current	I_{KM}	125	A
Anode dissipation	P_A	110	kW
Grid dissipation	P_G	2,0	kW

Operating characteristics

Frequency	f	≤ 30	MHz
Carrier power	P_{trg}	110 + 12,6 [2])	kW [1])
Anode voltage (dc)	U_A	11	kV
Grid bias (dc), fixed	$U_{G\,fix}$	– 200	V
Grid resistance	R_G	190	Ω
Peak grid voltage (ac)	$U_{g\,m}$	1200	V
Anode current (dc)	I_A	12	A
Grid current (dc)	I_G	3,1	A
Anode input power	P_{BA}	132	kW
Drive power	P_1	3,4 + 12,6 [2])	kW [1])
Anode dissipation	P_A	22	kW [3])
Grid dissipation	P_G	0,96	kW
Efficiency	η	83	%
Anode load resistance	R_A	560	Ω
Modulation factor	m	100	%
Modulation power	P_{mod}	66	kW
Grid dissipation at modulation	$P_{G\,mod}$	1,32	kW [4])
Peak grid voltage (ac)	$U_{g\,m}$	1800	V [5])
Grid current (dc)	I_G	5,1	A [5])
Drive power	P_1	8,7 + 38 [2])	kW [1]) [5])
Anode dissipation at modulation	$P_{A\,mod}$	33	kW

1) Circuit losses are not included.
2) Power transition of the grounded grid circuit.
3) Even during modulation the indicated maximum ratings must not be exceeded. It has to be observed that during 100 % modulation the plate dissipation increases to about 1,5 times the power dissipation stated for the carrier value.
4) Average value at m = 100 %.
5) Maximum values at peak modulation.

AF amplifier and modulator, class B operation, 2 tubes in push-pull circuit

Maximum ratings

Anode voltage (dc)	U_A	12	kV
Grid voltage (dc)	U_G	– 800	V
Cathode current (dc)	I_K	25	A
Peak cathode current	I_{KM}	80	A
Anode dissipation	P_A	110	kW
Grid dissipation	P_G	2,0	kW

Operating characteristics

at modulator operation for

		300 kW carrier power		200 kW carrier power		
Output power	P_2	0	230	0	155	kW
Anode voltage (dc)	U_A	11	11	8,0	8,0	kV
Grid voltage (dc)	U_G	– 200	– 200	– 160	– 160	V
Peak control grid voltage (ac) between the 2 tubes	$U_{gg\,m}$	0	1060	0	950	V
Anode current (dc)	I_A	2 × 2	2 × 15,1	2 × 1,2	2 × 14,3	A
Grid current (dc)	I_G	0	2 × 2,6	0	2 × 2,6	A
Peak grid current	I_{GM}	0	2 × 13	0	2 × 13	A
Anode input power	P_{BA}	2 × 22	2 × 166	2 × 9,6	2 × 114	kW
Drive power	P_1	0	2 × 1,3	0	2 × 1,2	kW
Anode dissipation	P_A	2 × 22	2 × 51	2 × 9,6	2 × 36,5	kW
Grid dissipation	P_G	0	2 × 780	0	2 × 750	W
Efficiency	η	–	69,3	–	68	%
Effective load resistance (anode to anode)	R_{AA}	–	870	–	670	Ω

Tube mounting

Axis vertical, anode down.

For connection of the cathode use the terminals listed under “Accessories”.

For connecting the grid, M5 tapholes are provided at the grid terminal ring; knurled head screws are included in delivery.

Maximum tube surface temperature

The temperature of the glass and metal parts and of the cathode terminals must not exceed 220 °C at any point. At f > 10 MHz an equally distributed slight air stream on the grid connector ring and the cathode terminal pins is required.

Vapor cooling

Cooling data for maximum anode dissipation	$P_{A\,max}$ = 110 kW
Total power to be dissipated by the cooling system ($P_A + P_G + 0{,}8\ P_F$)	114,5 kW
Equivalent thermal output	6860 kJ/min (1640 kcal/min)
Flow rate of returning water	
at returning water temperature of 20 °C	approx. 2,7 l/min
at returning water temperature of 90 °C	approx. 3,1 l/min
Volume of generated vapor	
at returning water temperature of 20 °C	approx. 4,5 m^3/min
at returning water temperature of 90 °C	approx. 5,1 m^3/min

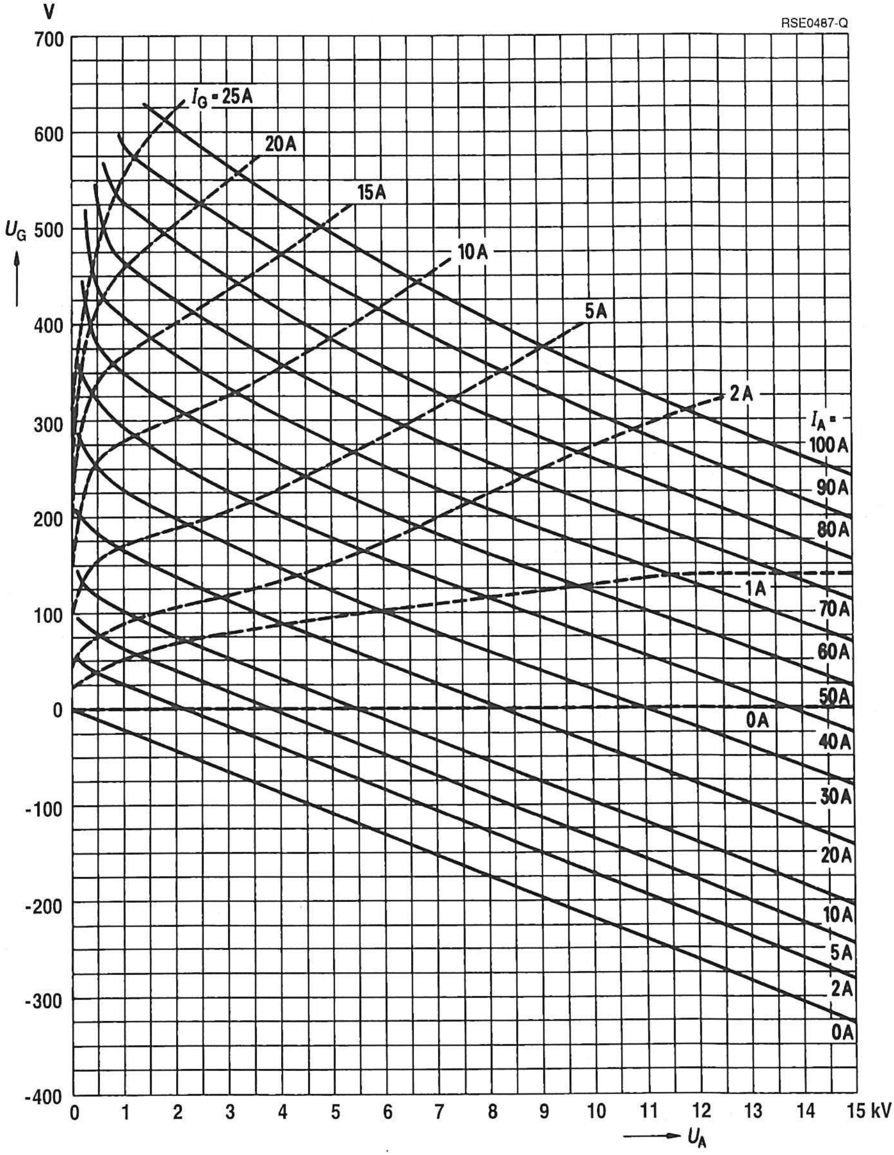
Detailed information on vapor cooling upon request. Please observe instructions on vapor cooling given under “Explanations on Technical Data”.

Safety precautions

The section “Safety precautions” under “Explanations on Technical Data” describes how the tube is to be protected against damage due to electric overload or insufficient cooling. A copper wire with 0,26 mm diameter should be used to test the anode overcurrent trip circuit.

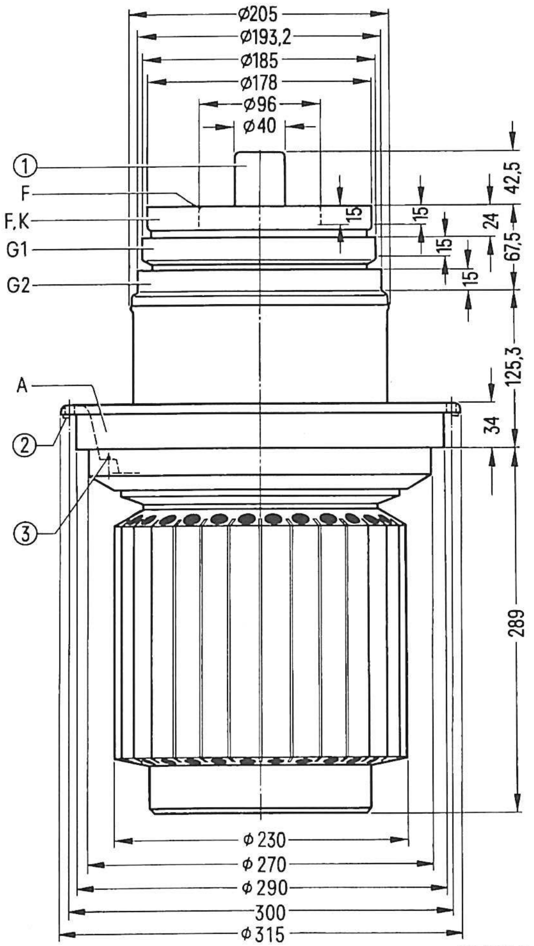
For protection against thermal anode overload the tube fuse RöSich4 is recommended. In conjunction with pull switch RöKt11 it disconnects the voltages at the tube in case of overload (see accessories).

$U_G = f(U_A)$ Parameter = I_A ———————
Parameter = I_G — — — — — — — —



For power transmitters Ordering code Q53-X2002

Coaxial tetrode in metal-glass-ceramic technology, vapor-cooled, suitable for single-sideband communications transmitters up to 100 kW, broadcast transmitters up to 200 kW medium and short wave, and for modulators in transmitters up to 400 kW.



RSE0488-Y

Dimensions in mm

① Do not use as terminal
② Taphole M8 for screw-in handle RöZub41V or RöZub202V
③ Taphole M5 for tube fuse RöSich4

Approx. weight 51 kg

Heating

Heater voltage	U_F	21	V
Heater current	I_F	≈ 350	A
Heating: direct			
Cathode: thoriated tungsten			

Characteristics

Emission current at $U_A = U_{G2} = U_{G1} = 700$ V	I_{em}	280	A
Amplification factor of screen grid at $U_A = 3$ kV, $U_{G2} = 800$ to 1200 V, $I_A = 10$ A	μ_{g2g1}	4,0	
Transconductance at $U_A = 3$ kV, $U_{G2} = 1000$ V, $I_A = 10$ A	s	130	mA/V

Capacitances

Cathode/control grid	c_{kg1}	≈ 265	pF
Cathode/screen grid	c_{kg2}	≈ 35	pF
Cathode/anode	c_{ka}	≈ 1,9	pF 1)
Control grid/screen grid	c_{g1g2}	≈ 360	pF
Control grid/anode	c_{g1a}	≈ 9,0	pF 1)
Screen grid/anode	c_{g2a}	≈ 118	pF

1) Measured by means of a 50 cm diameter screening plate in the screen grid terminal plane.

Accessories		Ordering code
Mounting instruction	RöMo14	
Mounting instruction	RöMo95	
Cathode terminal	RöKat202	C65055-A805-A61
Cathode connecting strip (4 for each tube)	RöKat221	Q81-X1136
Control grid terminal	RöGit202a	Q81-X952
Screen grid terminal	RöGit202b	Q81-X953
SW header socket with, symmetrical cathode blocking	RöKpf202KS	Q81-X1806
MW header socket without blocking	RöKpf202MO	Q81-X1805
Socket wrench for tube fuse	RöZub10	Q81-X2110
Handle	RöZub41V	Q81-X2141
Handle	RöZub202V	Q81-X2156
Tube fuse	RöSich4	Q81-X1404
Pull switch for tube fuse	RöKt11	Q81-X1311
Boiler	RöKüV41	Q81-X1641
Insulating pipe at vapor outlet	RöKüV41Zub3	Q81-X1643
Insulating pipe at water inlet	RöKüV41Zub4	Q81-X1644
Insulator	RöKüV41Zub5K	Q81-X1646
Union at water inlet	RöKüV41Zub7	Q81-X1647
Gasket at vapor outlet	RöKüV41Zub8	Q81-X1648
Water level stabilizer with control electrodes	RöZubV4	Q81-X2105
LL electrolytic target	RöEl23	C65055-A667-A23
Gasket ring for boiler	RöN9374	C65051-A202-C553

Anode and screen grid modulation, class C operation, grounded cathode circuit

Maximum ratings

Frequency	f	30	MHz
Anode voltage (dc)	U_A	11,5	kV
Screen grid voltage (dc)	U_{G2}	1000	V
Control grid voltage (dc)	U_{G1}	– 800	V
Cathode current (dc)	I_K	60	A
Peak cathode current	$I_{K\,M}$	280	A
Anode dissipation	P_A	150	kW
Screen grid dissipation	P_{G2}	2400	W [4])
Control grid dissipation	P_{G1}	1200	W

Operating characteristics

Frequency	f	≤ 30	≤ 30	≤ 30	MHz
Carrier power	P_{trg}	220	165	110	kW [1])
Anode voltage (dc)	U_A	11	10	9	kV
Screen grid voltage (dc)	U_{G2}	800	800	800	V
Control grid bias (dc), fixed	$U_{G1\,fix}$	– 590	– 400	– 350	V
Control grid resistance	R_{G1}	60	320	600	Ω
Peak control grid voltage (ac)	$U_{g1\,m}$	960	960	800	V
Anode current (dc)	I_A	25	20	14,5	A
Screen grid current (dc)	I_{G2}	2,5	2,2	1,2	A
Control grid current (dc)	I_{G1}	1,6	1,0	0,5	A
Anode input power	$P_{B\,A}$	275	200	130	kW
Drive power	P_1	1400	870	360	W [1])
Anode dissipation	P_A	55	35	20	kW [2])
Screen grid dissipation	P_{G2}	2000	1750	960	W
Control grid dissipation	P_{G1}	300	150	35	W
Efficiency	η	80	83	84	%
Anode load resistance	R_A	237	255	306	Ω
Modulation factor	m	100	100	100	%
Peak screen grid voltage (ac)	$U_{g2\,m}$	700	500	400	V [3])
Modulation power	P_{mod}	140	100	65	kW
Control grid current (dc)	I_{G1}	2,3	2,5	1,0	A [5])
Drive power	P_1	2200	2200	800	W [1]) [5])
Anode dissipation at modulation	$P_{A\,mod}$	82,5	53	30	kW [6])
Screen grid dissipation at modulation	$P_{G2\,mod}$	2200	2200	1200	W [6])

1) Circuit losses are not included.
2) Even during modulation the indicated maximum ratings must not be exceeded. It has to be observed that during 100 % modulation the anode dissipation increases to about 1,5 times the power dissipation stated for the carrier value.
3) Modulation of screen grid via separate transformer winding.
4) 2700 W are permitted for medium wave.
5) Maximum values at $U_A = 0$ V.
6) Average values at $m = 100$ %.

AF amplifier and modulator, class B operation, 2 tubes in push-pull circuit, $I_{G1} = 0$

Maximum ratings

Anode voltage (dc)	U_A	12	kV
Screen grid voltage (dc)	U_{G2}	1600	V
Control grid voltage (dc)	U_{G1}	– 800	V
Cathode current (dc)	I_K	50	A
Peak cathode current	$I_{K\,M}$	280	A
Anode dissipation	P_A	150	kW
Screen grid dissipation	P_{G2}	2700	W
Control grid dissipation	P_{G1}	1200	W
Control grid resistance	R_{G1}	2,0	kΩ

Operating characteristics

at modulator operation for

		400 kW carrier power		300 kW carrier power		
Output power	P_2	0	280	0	210	kW
Anode voltage (dc)	U_A	11	11	11	11	kV
Screen grid voltage (dc)	U_{G2}	1500	1500	1500	1500	V
Control grid voltage (dc)	U_{G1}	– 520	– 520	– 520	– 520	V
Peak control grid voltage (ac) between the 2 tubes	$U_{gg\,m}$	0	1000	0	900	V
Anode current (dc)	I_A	2 × 3	2 × 20	2 × 3	2 × 15	A
Screen grid current (dc)	I_{G2}	0	2 × 0,5	0	2 × 0,4	A
Anode input power	$P_{B\,A}$	2 × 33	2 × 220	2 × 33	2 × 165	kW
Drive power	P_1	0	2 × 125	0	2 × 100	W [1]
Anode dissipation	P_A	2 × 33	2 × 80	2 × 33	2 × 60	kW
Screen grid dissipation	P_{G2}	0	2 × 750	0	2 × 600	W
Efficiency	η	–	63,5	–	63,5	%
Effective load resistance (anode to anode)	R_{AA}	–	550	–	750	Ω

1) Drive power at 1 kΩ grid resistance.

RF linear amplifier,
single-sideband modulation, grounded cathode circuit, $I_{G1} = 0$

Maximum ratings

Frequency	f	30	MHz
Anode voltage (dc)	U_A	15	kV
Screen grid voltage (dc)	U_{G2}	1600	V
Control grid voltage (dc)	U_{G1}	– 800	V
Cathode current (dc)	I_K	60	A
Peak cathode current	$I_{K\,M}$	280	A
Anode dissipation	P_A	150	kW
Screen grid dissipation	P_{G2}	2400	W
Control grid dissipation	P_{G1}	1200	W

Operating characteristics		I	II [1]	III [1]	
Output power	P_2	0	110	55	kW [2]
Anode voltage (dc)	U_A	10	10	10	kV
Screen grid voltage (dc)	U_{G2}	1500	1500	1500	V
Control grid voltage (dc)	U_{G1}	– 440	– 440	– 440	V
Peak control grid voltage (ac)	$U_{g1\,m}$	0	420	420	V
Anode current (dc)	I_A	7,0	18,3	11,6	A
Screen grid current (dc)	I_{G2}	0	0,7	0,4	A
Anode input power	$P_{B\,A}$	70	183	116	kW
Anode dissipation	P_A	70	73	61	kW
Screen grid dissipation	P_{G2}	0	1050	600	W
Efficiency	η	–	60	47,5	%

I No modulation
II 1-tone modulation
III 2-tone modulation

1) Carrier suppressed.
2) Circuit losses are not included.

Tube mounting

Axis vertical, anode down. For connection of the tube use the terminals listed under "Accessories". The complete header sockets are intended for transmitter operation in medium and short-wave range and can be selected corresponding to the required circuit. The individual connectors can be used for modulator operation.

Maximum tube surface temperature

The temperature of the glass bulb and of the glass-metal seals must not exceed 180 °C at any point. In SW transmitters using single-sideband resonant circuits, the glass bulb will be unilaterally heated by RF reactive currents. A unilateral air stream must be provided to ensure that the temperature on this side will not exceed 180 °C.
The maximum temperature of the metal-ceramic seals is 220 °C. When using the individual connectors for modulators, a slight air stream is required in order to maintain these maximum temperatures.

The header sockets for transmitter operation are provided with a centrally located cooling air terminal allowing uniform cooling air distribution over the terminal parts. The cooling air amount necessary for keeping below the specified temperatures lies between 0,5 and 1 m^3/min, according to the operating frequency. The pressure drop is approx. 3,5 mbar.

Vapor cooling

Cooling specifications for maximum anode dissipation	$P_{A\,max}$ = 150 kW
Total power to be dissipated by the cooling system ($P_A + P_{G2} + P_{G1} + 0{,}8\ P_F$)	160 kW
Equivalent thermal output	9600 kJ/min (2300 kcal/min)
Flow rate of returning water	
at returning water temperature of 20 °C	approx. 3,7 l/min
at returning water temperature of 90 °C	approx. 4,2 l/min
Volume of generated vapor	
at returning water temperature of 20 °C	approx. 6,2 m^3/min
at returning water temperature of 90 °C	approx. 7,0 m^3/min

Detailed information on vapor cooling upon request. Please observe the instructions on vapor cooling given under "Explanations on Technical Data".

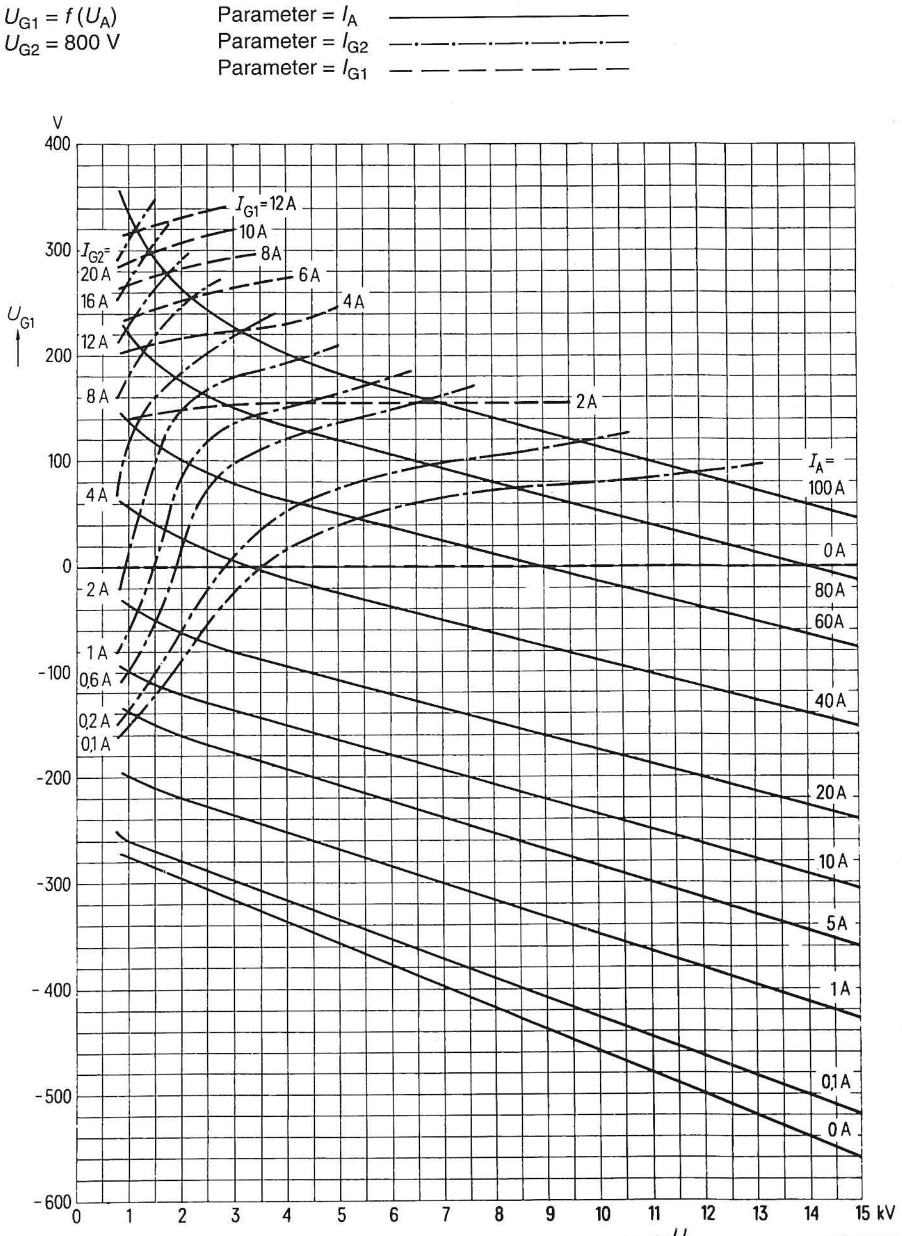
Safety precautions

The section "Safety precautions" under "Explanations on Technical Data" describes how the tube is to be protected against damage due to electric overload or insufficient cooling. A copper wire with 0,30 mm diameter should be used to test the anode overcurrent trip circuit.

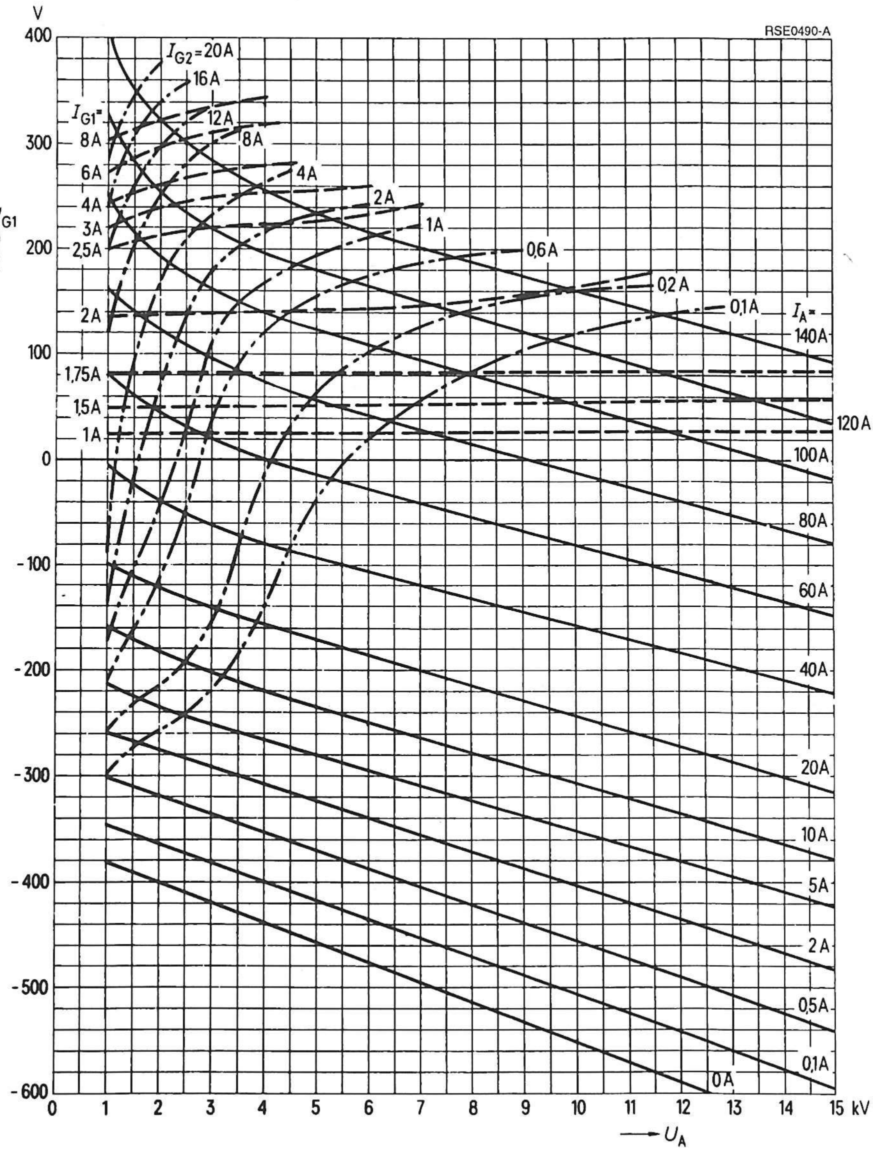
For protection against thermal anode overload the tube fuse RöSich4 is recommended. In conjunction with pull switch RöKt11 it disconnects the voltages at the tube in case of overload (see accessories).

The protective gap required between screen grid and cathode is already included in the MW header sockets available for this tube.

$U_{G1} = f(U_A)$
$U_{G2} = 800$ V

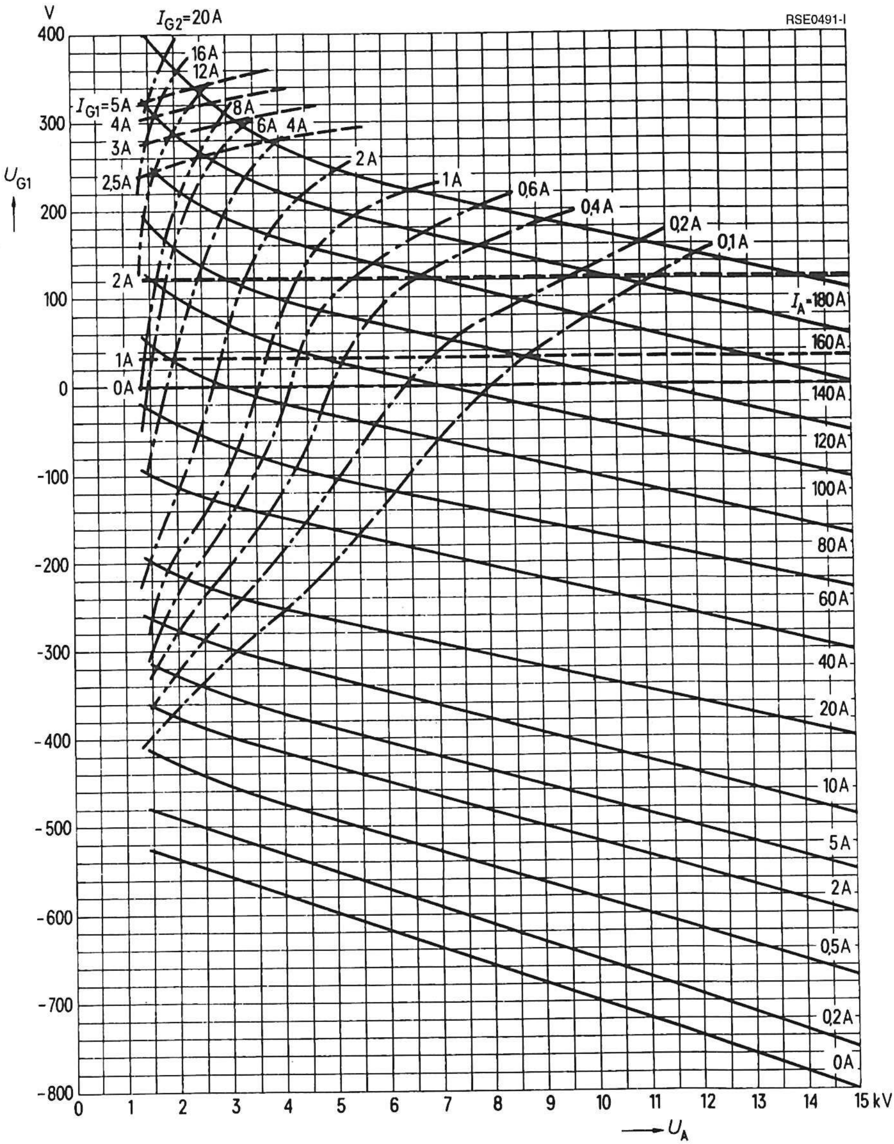


$U_{G1} = f(U_A)$ Parameter = I_A ————————
$U_{G2} = 1100$ V Parameter = I_{G2} —·—·—·—·—
Parameter = I_{G1} — — — — — — —



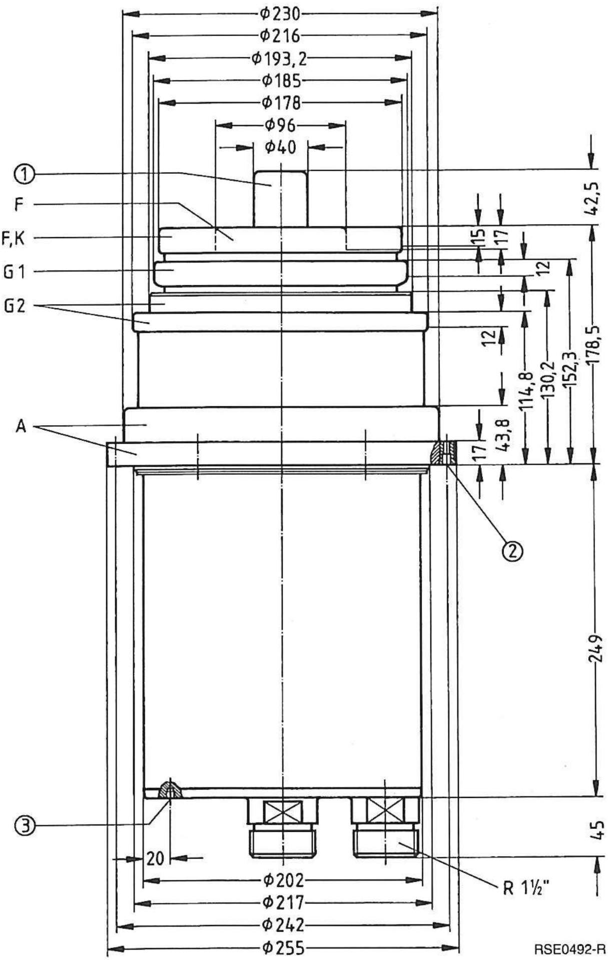
$U_{G1} = f(U_A)$
$U_{G2} = 1500$ V

Parameter = I_A ————
Parameter = I_{G2} —·—·—·—
Parameter = I_{G1} — — — —



For frequencies up to 220 MHz Ordering code Q52-X2004

Coaxial metal-ceramic tetrode, water-cooled with integrated cooling jacket, particularly suitable for RF amplifiers up to 220 MHz.



RSE0492-R

Dimensions in mm

① Do not use as terminal
② 6 tapholes M6 for handle RöZub204
③ Taphole M6 for anode voltage terminal, 5 mm deep

Approx. weight 35 kg

Heating

Heater voltage	U_F	6,5	V
Heater current	I_F	≈ 680	A
Heating: direct			
Cathode: thoriated tungsten			

Characteristics

Emission current at $U_A = U_{G2} = U_{G1} = 600$ V	I_{em}	160	A
Amplification factor of screen grid at $U_A = 3$ kV, $U_{G2} = 800$ to 1200 V, $I_A = 10$ A	μ_{g2g1}	4,0	
Transconductance at $U_A = 3$ kV, $U_{G2} = 1000$ V, $I_A = 10$ A	s	95	mA/V

Capacitances

Cathode/control grid	c_{kg1}	≈ 205	pF
Cathode/screen grid	c_{kg2}	≈ 22	pF
Cathode/anode	c_{ka}	≈ 1,2	pF [1])
Control grid/screen grid	c_{g1g2}	≈ 230	pF
Control grid/anode	c_{g1a}	≈ 5,0	pF [1])
Screen grid/anode	c_{g2a}	≈ 90	pF

Accessories

		Ordering code
Cathode terminal	RöKat202	C65055-A805-A61
Cathode connecting strip (4 for each tube)	RöKat221	Q81-X1136
Control grid terminal	RöGit202a	Q81-X952
Screen grid terminal	RöGit202b	Q81-X953
Handle	RöZub204	C65055-A761-A72
LL electrolytic target for $1^1/_2$″ hose	RöEl1	Q81-X334
LL electrolytic target for $1^1/_4$″ hose	RöEl7	Q81-X512

1) Measured by means of a 50 cm diameter screening plate in the screen grid terminal plane.

RF amplifier,
class B operation, grounded control-grid screen-grid circuit

Maximum ratings

Frequency	f	220	MHz
Anode voltage (dc)	U_A	9,0	kV
Screen grid voltage (dc)	U_{G2}	1200	V
Control grid voltage (dc)	U_{G1}	– 600	V
Cathode current (dc)	I_K	30	A
Peak cathode current	$I_{K\,M}$	160	A
Anode dissipation	P_A	120	kW
Screen grid dissipation	P_{G2}	1200	W
Control grid dissipation	P_{G1}	400	W

Operating characteristics

Frequency	f	200	200	MHz
Output power	P_2	129 + 11 [2])	117 + 10 [2])	kW [1])
Anode voltage (dc)	U_A	8,5	8,5	kV
Screen grid voltage (dc)	U_{G2}	1100	1100	V
Control grid voltage (dc)	U_{G1}	– 400	– 400	V [3])
Peak control grid voltage (ac)	$U_{g1\,m}$	600	570	V
Anode current (dc)	I_A	24	23	A
Screen grid current	I_{G2}	0,9	0,6	A
Control grid current (dc)	I_{G1}	0,7	0,4	A
Anode input power	$P_{B\,A}$	204	195	kW
Drive power	P_1	0,4 + 11 [2])	0,2 + 10 [2])	kW [1])
Anode dissipation	P_A	75	78	kW
Screen grid dissipation	P_{G2}	1100	740	W
Control grid dissipation	P_{G1}	120	40	W
Efficiency	η	63	60	%
Anode load resistance	R_A	200	200	Ω

1) Circuit losses are not included.
2) Power transition of the grounded control-grid screen-grid circuit.
3) For zero signal dc anode current $I_{A\,0}$ = 3 A.

RF amplifier, pulse operation, class B operation, grounded control-grid screen-grid circuit

Maximum ratings

Frequency	f	220	MHz
Anode voltage (dc)	U_A	11,5	kV
Screen grid voltage (dc)	U_{G2}	1200	V
Control grid voltage (dc)	U_{G1}	– 600	V
Cathode current (dc)	I_K	50	A
Peak cathode current	$I_{K\,M}$	160	A
Anode dissipation	P_A	180	kW
Screen grid dissipation	P_{G2}	1480	W
Control grid dissipation	P_{G1}	500	W

Operating characteristics

Frequency	f	200	MHz
Pulse duration	t_p	1,0	s
Pulse separation	t_0	3,0	s
Pulse output power	$P_{2\,p}$	215	kW [1])
Anode voltage (dc)	U_A	9,5	kV
Screen grid voltage (dc)	U_{G2}	1150	V
Control grid voltage (dc)	U_{G1}	– 400	V
Peak pulse control grid voltage (ac)	$U_{g1\,m\,p}$	660	V
Pulse anode current (dc)	$I_{A\,p}$	36	A
Pulse screen grid current (dc)	$I_{G2\,p}$	1,0	A
Pulse control grid current (dc)	$I_{G1\,p}$	1,0	A
Pulse anode input power	$P_{B\,A\,p}$	342	kW
Pulse drive power	$P_{1\,p}$	18	kW [1])
Pulse anode dissipation	$P_{A\,p}$	143	kW
Pulse screen grid dissipation	$P_{G2\,p}$	1150	W
Pulse control grid dissipation	$P_{G1\,p}$	250	W
Pulse efficiency	η_p	58	%
Anode load resistance	R_A	176	Ω

1) Circuit losses are not included.

Tube mounting

Axis vertical, anode up or down.

When the tube is mounted with the anode up, the connecting piece at the edge has to be used for the water inlet. When the tube is mounted with the anode down, the connecting piece in the middle has to be used.

For connection of the cathode use the terminals listed under "Accessories".

Maximum tube surface temperature

The temperature of the tube's metal-ceramic seals must not exceed 220 °C at any point. Sufficient cooling of the tube terminals has therefore to be provided.

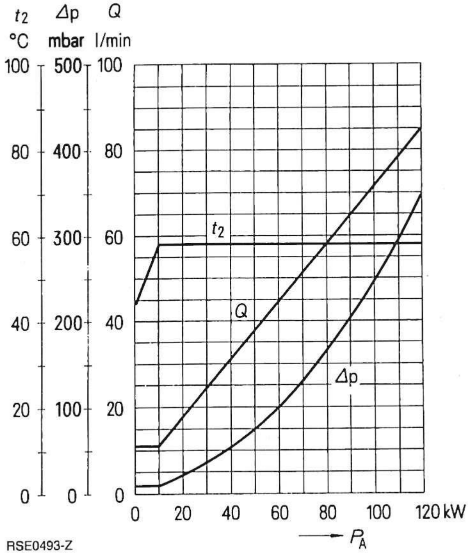
Water cooling

The cooling water diagram is valid for 35 °C water inlet temperature. The water outlet temperature must not exceed 65 °C. The maximum permissible pressure of the cooling water is 5 bar. Please observe instructions on water cooling given under "Explanations on Technical Data".

Safety precautions

The section "Safety precautions" under "Explanations on Technical Data" describes how the tube is to be protected against damage due to electric overload or insufficient cooling. A copper wire with 0,20 mm diameter should be used to test the anode overcurrent trip circuit.

Cooling water diagram

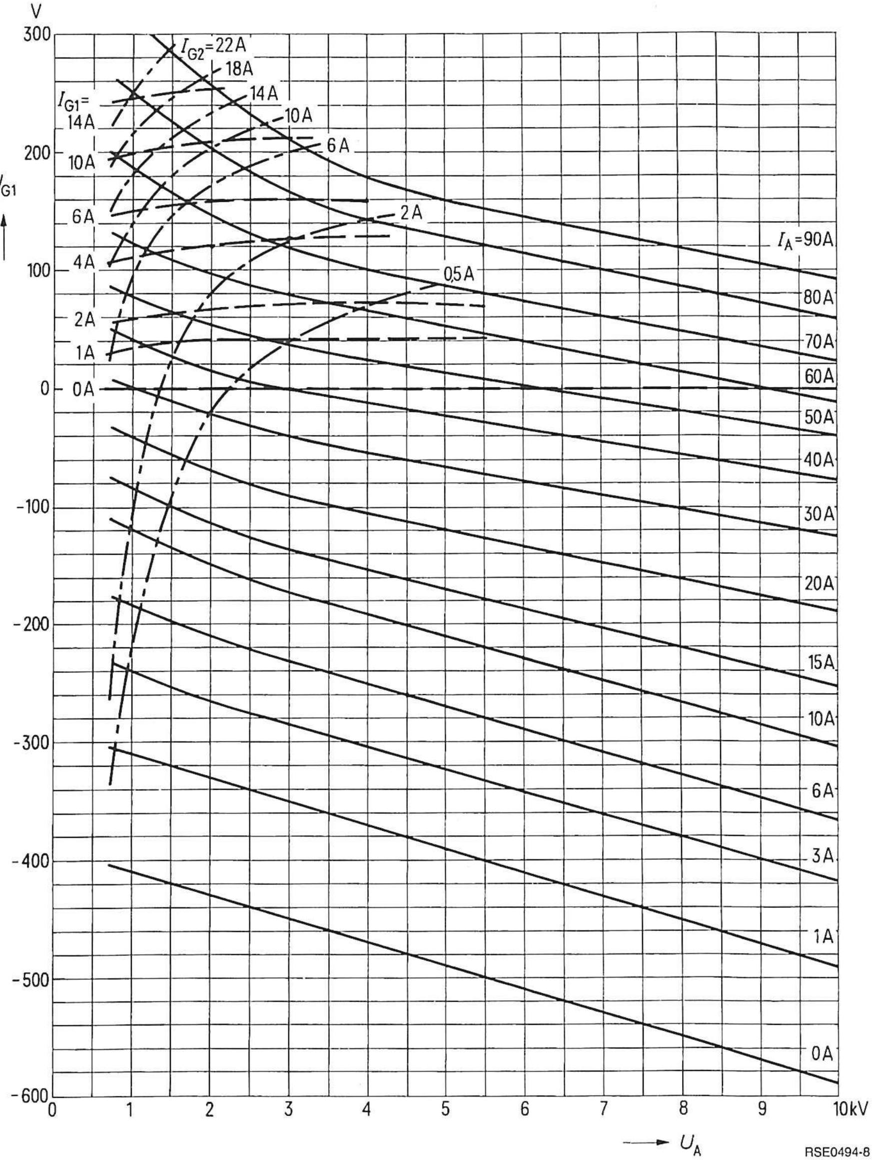


RSE0493-Z

t_1 = 35 °C

$U_{G1} = f(U_A)$
$U_{G2} = 1100$ V

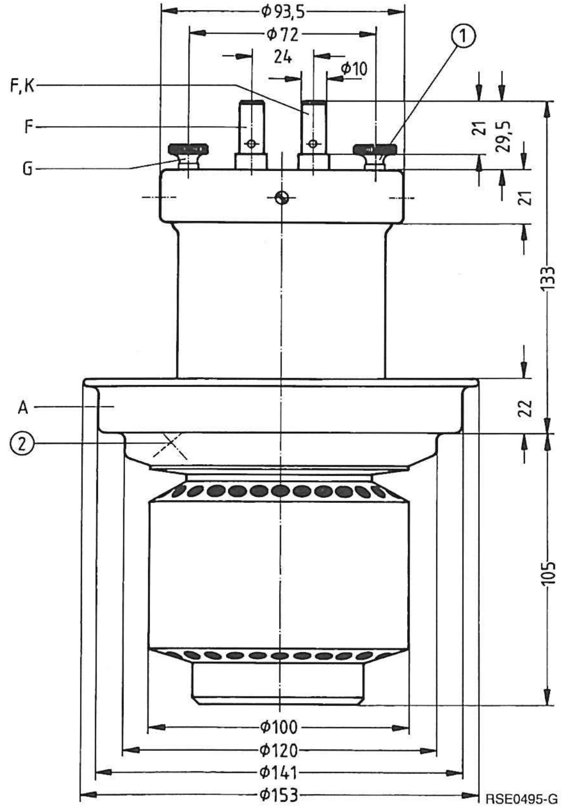
Parameter = I_A ————————
Parameter = I_{G2} —·—·—·—·—
Parameter = I_{G1} — — — — — —



Ordering code Q53-X2011

Vapor-cooled triode with coaxial grid lead-through. Due to the low amplification factor the tube is particularly suitable for driver stages of AF amplifiers and modulators in sequential cathode circuit.

When used as RF amplifier the tube can be operated at 11 kV up to 30 MHz and at 8 kV up to 70 MHz.



Dimensions in mm

① 4 tapholes M4 (4 × 90°)
② Taphole M5 for tube fuse RöSich4

Approx. weight 4 kg

Heating

Heater voltage	U_F	10	V
Heater current	I_F	≈ 70	A
Heating: direct			
Cathode: thoriated tungsten			

Characteristics

Emission current at $U_A = U_G = 400$ V	I_{em}	20	A
Amplification factor at $U_A = 1$ to 6 kV, $I_A = 1$ A	μ	15	
Transconductance at $U_A = 3$ kV, $I_A = 1$ A	s	20	mA/V

Capacitances

Cathode/grid	c_{kg}	≈ 48	pF
Cathode/anode	c_{ka}	≈ 1,3	pF [1]
Grid/anode	c_{ga}	≈ 23	pF

Accessories		**Ordering code**
Mounting instruction	RöMo45	
Mounting instruction	RöMo54	
Cathode connecting strip (2 for each tube)	RöKat61	Q81-X1161
Socket wrench for tube fuse	RöZub10	Q81-X2110
Tube fuse	RöSich4	Q81-X1404
Pull switch for tube fuse	RöKt11	Q81-X1311
Boiler	RöKüV61	Q81-X1661
Insulating pipe at water inlet	RöKüV01Zub4	Q81-X1604
Union at water inlet	RöKüV01Zub7	Q81-X1607
Gasket at vapor outlet	RöKüV01Zub8	Q81-X1608
Insulating pipe at vapor outlet	RöKüV31Zub3	Q81-X1633
Insulator	RöKüV61Zub5K	Q81-X1666
Water level stabilizer with control electrodes	RöZubV4	Q81-X2105
LL electrolytic target	RöEl21	C65055-A667-A21
Gasket ring for boiler	RöN9370	C65051-A360-C516

1) Measured by means of a 30 cm × 30 cm screening plate in the grid terminal plane.

RF amplifier, class C operation, grounded cathode circuit

Maximum ratings

Frequency	f	30	70	MHz
Anode voltage (dc)	U_A	11	8,0	kV
Grid voltage (dc)	U_G	– 1200	– 1200	V
Cathode current (dc)	I_K	5,0	5,0	A
Peak cathode current	$I_{K\,M}$	20	20	A
Anode dissipation	P_A	12	12	kW
Grid dissipation	P_G	100	60	W

Operating characteristics

Frequency	f	≤ 30	≤ 70	MHz
Output power	P_2	22	12	kW [1])
Anode voltage (dc)	U_A	10	7,0	kV
Grid voltage (dc)	U_G	– 960	– 700	V
Peak grid voltage (ac)	$U_{g\,m}$	1260	950	V
Anode current (dc)	I_A	2,8	2,3	A
Grid current (dc)	I_G	275	250	mA
Anode input power	$P_{B\,A}$	28	16	kW
Drive power	P_1	335	210	W [1])
Anode dissipation	P_A	6,0	4,0	kW
Grid dissipation	P_G	70	35	W
Efficiency	η	78,5	75	%
Anode load resistance	R_A	1840	1500	Ω

1) Circuit losses are not included.

Anode voltage modulation, grounded cathode circuit

Maximum ratings

Frequency	f	30	MHz
Anode voltage (dc)	U_A	6,5	kV
Grid voltage (dc)	U_G	– 1200	V
Cathode current (dc)	I_K	5,0	A
Peak cathode current	I_{KM}	20	A
Anode dissipation	P_A	12	kW
Grid dissipation	P_G	100	W

Operating characteristics

Frequency	f	≤ 30	MHz
Carrier power	P_{trg}	6,0	kW [1]
Anode voltage (dc)	U_A	6,0	kV
Grid bias (dc), fixed	$U_{G\,fix}$	– 400	V
Grid resistance	R_G	3,0	kΩ
Peak grid voltage (ac)	$U_{g\,m}$	1260	V
Anode current (dc)	I_A	1,25	A
Grid current (dc)	I_G	210	mA
Anode input power	P_{BA}	7,5	kW
Drive power	P_1	260	W [1]
Anode dissipation	P_A	1,5	kW [2]
Grid dissipation	P_G	40	W
Efficiency	η	80	%
Anode load resistance	R_A	2,7	kΩ
Modulation factor	m	100	%
Modulation power	P_{mod}	3,75	kW
Grid current (dc)	I_G	240	mA [3]
Drive power	P_1	295	W [1] [3]
Grid current (dc)	I_G	200	mA [4]
Drive power	P_1	245	W [1] [4]

1) Circuit losses are not included.
2) Even during modulation the indicated maximum ratings must not be exceeded. It has to be observed that during 100 % modulation the anode dissipation increases to about 1,5 times the power dissipation stated for the carrier value.
3) Maximum values at $U_A = 0$ V.
4) Maximum values at peak modulation.

VX

AF amplifier and modulator, class B operation, 2 tubes in push-pull circuit

Maximum ratings

Anode voltage (dc)	U_A	11	kV
Grid voltage (dc)	U_G	– 1000	V
Cathode current (dc)	I_K	5,0	A
Peak cathode current	I_{KM}	20	A
Anode dissipation	P_A	12	kW
Grid dissipation	P_G	100	W
Grid resistance	R_G	10	kΩ

Operating characteristics

P_2	0	39	0	16	0	16	kW
U_A	10	10	10	10	10	10	kV
U_G	– 750	– 750	– 750	– 750	– 750	– 750	V
$U_{gg\,m}$	0	1950	0	1720	0	1500	V
I_A	2 × 0,3	2 × 2,67	2 × 0,3	2 × 1,1	2 × 0,3	2 × 1,5	A
I_G	0	2 × 185	0	2 × 42	0	0	mA
I_{GM}	0	2 × 1,6	0	2 × 0,42	0	0	A
P_{BA}	2 × 3	2 × 26,7	2 × 3	2 × 11	2 × 3	2 × 15	kW
P_1	0	2 × 170	0	2 × 32	0	0	W
P_A	2 × 3	2 × 7,2	2 × 3	2 × 3	2 × 3	2 × 7	kW
P_G	0	2 × 30	0	2 × 1	0	0	W
η	–	73	–	73	–	53	%
R_{AA}	–	4,15	–	10,1	–	6,1	kΩ

AF amplifier and modulator, class B operation, 2 tubes in push-pull circuit

Maximum ratings

Anode voltage (dc)	U_A	11	kV
Grid voltage (dc)	U_G	– 1000	V
Cathode current (dc)	I_K	5,0	A
Peak cathode current	$I_{K\,M}$	20	A
Anode dissipation	P_A	12	kW
Grid dissipation	P_G	100	W
Grid resistance	R_G	10	kΩ

Operating characteristics

P_2	0	16	0	10	0	10	kW
U_A	8,0	8,0	8,0	8,0	8,0	8,0	kV
U_G	– 600	– 600	– 610	– 610	– 620	– 620	V
$U_{gg\,m}$	0	1470	0	1380	0	1220	V
I_A	2 × 0,25	2 × 1,4	2 × 0,2	2 × 0,9	2 × 0,15	2 × 1,1	A
I_G	0	2 × 60	0	2 × 27	0	0	mA
$I_{G\,M}$	0	2 × 0,6	0	2 × 0,27	0	0	A
$P_{B\,A}$	2 × 2	2 × 11,2	2 × 1,6	2 × 7,2	2 × 1,2	2 × 8,8	kW
P_1	0	2 × 43	0	2 × 18	0	0	W
P_A	2 × 2	2 × 3,2	2 × 1,6	2 × 2,2	2 × 1,2	2 × 3,8	kW
P_G	0	2 × 7	0	2 × 1,5	0	0	W
η	–	72	–	70	–	57	%
R_{AA}	–	6,12	–	9,8	–	5,5	kΩ

Driver stage for AF amplifier and modulator,
class B operation, 2 tubes in push-pull circuit, cathode follower, $I_G = 0$

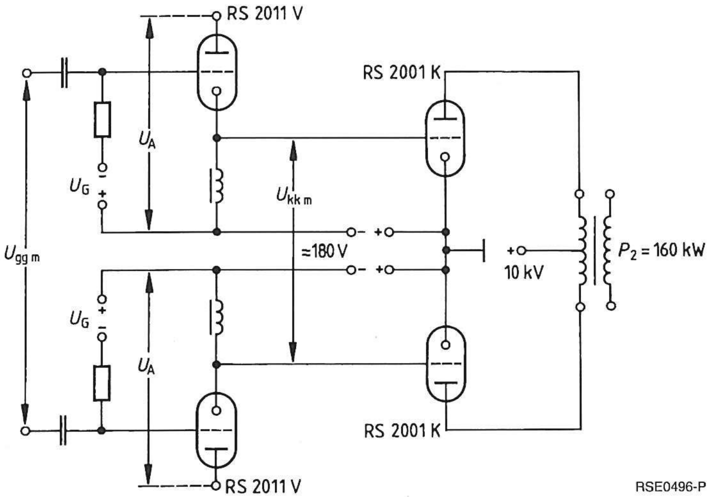
Maximum ratings

Anode voltage (dc)	U_A	11	kV
Grid voltage (dc)	U_G	– 1000	V
Cathode current (dc)	I_K	5,0	A
Peak cathode current	I_{KM}	20	A
Anode dissipation	P_A	12	kW
Grid dissipation	P_G	100	W
Grid resistance	R_G	10	kΩ

Operating characteristics (see circuit example)

Anode voltage (dc)	U_A	4,9	4,9	kV
Grid voltage (dc)	U_G	– 320	– 320	V
Peak control grid voltage (ac) between the 2 tubes	$U_{gg\,m}$	0	1550	V
Peak cathode voltage (ac) between the 2 tubes	$U_{kk\,m}$	0	910	V
Cathode current (dc)	I_K	2 × 0,5	2 × 1,85	A
Peak cathode current	I_{KM}	(2 × 0,5)	2 × 9,8	A
Anode input power	P_{BA}	2 × 2,45	2 × 9,1	kW
Anode dissipation	P_A	2 × 2,45	2 × 8,35	kW

Circuit example



Tube mounting

Axis vertical, anode down.

For connection of the cathode use the terminals listed under “Accessories”.

A number of M4 tapholes is provided at the grid terminal ring for grid connection; the delivery includes knurled head screws for this purpose.

Maximum tube surface temperature

The temperature of the glass and metal parts and of the cathode terminals must not exceed 220 °C at any point.

Vapor cooling

Cooling data for maximum anode dissipation	$P_{A\,max}$ = 12 kW
Total power dissipated by the cooling system ($P_A + P_G + 0{,}8\ P_F$)	12,7 kW
Equivalent thermal output	760 kJ/min (182 kcal/min)
Flow rate of returning water	
at returning water temperature of 20 °C	approx. 0,30 l/min
at returning water temperature of 90 °C	approx. 0,35 l/min
Volume of generated vapor	
at returning water temperature of 20 °C	approx. 0,50 m^3/min
at returning water temperature of 90 °C	approx. 0,56 m^3/min

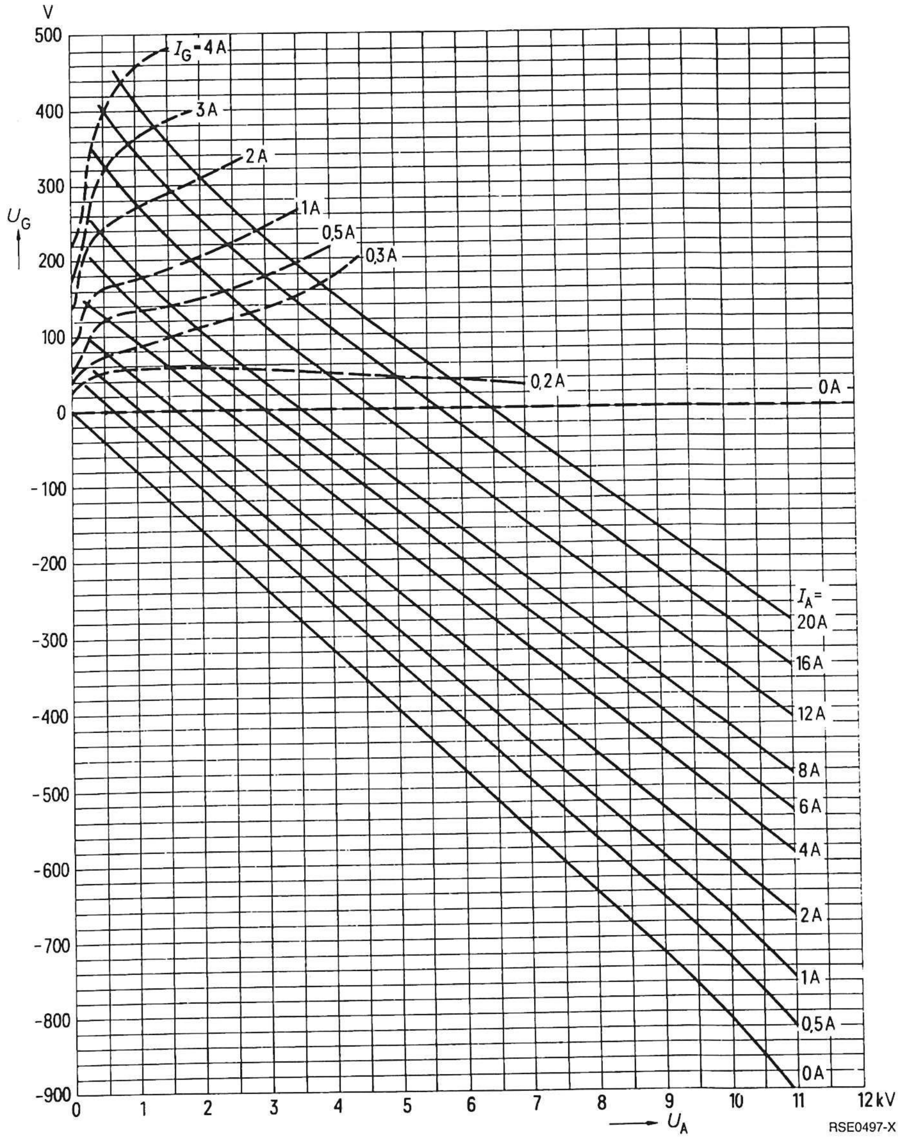
Detailed information on vapor cooling upon request. Please observe instructions on vapor cooling given under “Explanations on Technical Data”.

Safety precautions

The section “Safety precautions” under “Explanations on Technical Data” describes how the tube is to be protected against damage due to electric overload or insufficient cooling. A copper wire with 0,20 mm diameter should be used to test the anode overcurrent trip circuit.

For protection against thermal anode overload the tube fuse RöSich4 is recommended. In conjunction with pull switch RöKt11 it disconnects the voltages at the tube in case of overload (see accessories).

$U_G = f\,(U_A)$ Parameter = I_A ———
Parameter = I_G – – –



Coaxial metal-ceramic tetrode for frequencies up to 110 MHz, forced-air-cooled or water-cooled; particularly suitable for single-sideband communications transmitters up to 10 kW with grid-current free modulation.

Forced-air-cooled version

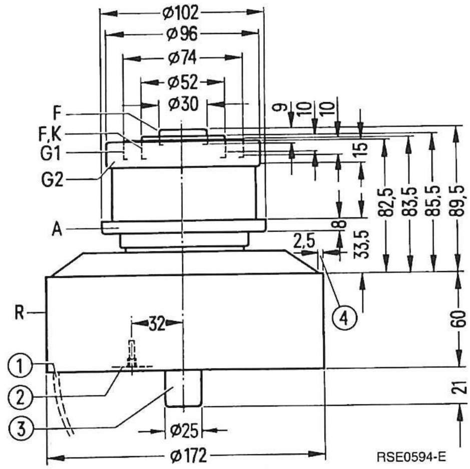
RS 2012 CL

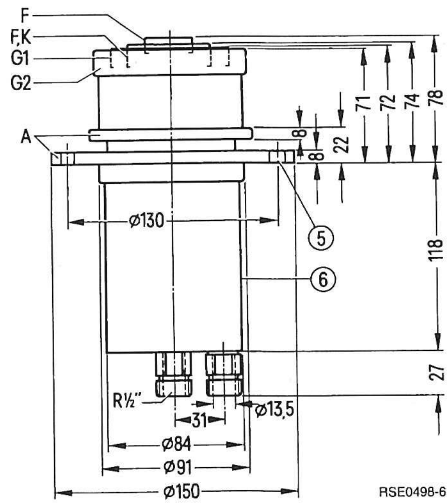
Ordering code Q51-X2012

Water-cooled version with integrated cooling jacket

RS 2012 CJ

Ordering code Q52-X2012





① Handle, swingable
② Taphole for tube fuse RöSich7
③ Do not use as terminal
④ Free for anode support
⑤ 6 fixing holes Ø 9 (6 × 60°)
⑥ Do not use cooling jacket as terminal for anode voltage

Dimensions in mm

Approx. weight 6,7 kg

Approx. 5,5 kg

The radiator and the terminals are of concentric design with the following diameters:

Radiator	Ø 173,5	Control grid terminal	Ø 75,0
Anode terminal	Ø 103,0	Heater/cathode terminal	Ø 52,6
Screen grid terminal	Ø 97,0	Heater terminal	Ø 30,6

Heating

Heater voltage	U_F	10	V
Heater current	I_F	≈ 83	A
Heating: direct			
Cathode: thoriated tungsten			

Characteristics

Emission current at $U_A = U_{G2} = U_{G1} = 300$ V	I_{em}	35	A
Amplification factor of screen grid at $U_A = 2$ kV, $U_{G2} = 600$ to 1000 V, $I_A = 3$ A	μ_{g2g1}	8,4	
Transconductance at $U_A = 2$ kV, $U_{G2} = 800$ V, $I_A = 2{,}5$ to $3{,}5$ A	s	70	mA/V

Capacitances

Cathode/control grid	c_{kg1}	≈ 76	pF
Cathode/screen grid	c_{kg2}	≈ 5,50	pF
Cathode/anode	c_{ka}	≈ 0,07	pF [1])
Control grid/screen grid	c_{g1g2}	≈ 122	pF
Control grid/anode	c_{g1a}	≈ 0,75	pF [1])
Screen grid/anode	c_{g2a}	≈ 22	pF

1) Measured by means of a 30 cm diameter screening plate in the screen-grid terminal plane.

Accessories

RS 2012 CL

		Ordering code
Cathode connecting strip (2 for each tube)	RöKat363	Q81-X1174
Header socket without blocking	RöKpf212	Q81-X1812
SW header socket with screen grid blocking against cathode	RöKpf212K	Q81-X1814
Socket wrench for tube fuse	RöZub09	Q81-X2109
Tube fuse	RöSich7	Q81-X1407
Pull switch for tube fuse	RöKt11	Q81-X1311
Joining piece for air duct	RöAnst212	Q81-X712
Spring-finger contacts:		
Internal cathode terminal		C65055-A815-C901
External cathode terminal		C65055-A815-C902
Control grid terminal		C65055-A815-C903
Screen grid terminal		C65055-A815-C904

RS 2012 CJ

Cathode connecting strip (2 for each tube)	RöKat363	Q81-X1174
Spring-finger contacts:		
Internal cathode terminal		C65055-A815-C901
External cathode terminal		C65055-A815-C902
Control grid terminal		C65055-A815-C903
Screen grid terminal		C65055-A815-C904

RF amplifier, class B operation

Maximum ratings

Frequency		f	110	MHz
Anode voltage (dc)		U_A	7,5	kV
Screen grid voltage (dc)		U_{G2}	1000	V
Control grid voltage (dc)		U_{G1}	– 250	V
Cathode current (dc)		I_K	4,0	A
Peak cathode current		I_{KM}	35	A
Anode dissipation	(RS 2012 CL)	P_A	12	kW
Anode dissipation	(RS 2012 CJ)	P_A	18	kW [5]
Screen grid dissipation		P_{G2}	200	W
Control grid dissipation		P_{G1}	70	W

Operating characteristics

		I	II	II	
Frequency	f	≤ 110	50	≤ 110	MHz
Output power	P_2	11	15+0,26 [3]	10,8+0,23 [3]	kW [1]
Anode voltage (dc)	U_A	6,0	9,0	7,0	kV
Screen grid voltage (dc)	U_{G2}	800	800	800	V
Control grid voltage (dc)	U_{G1}	– 120	– 125	– 120	V [4]
Peak control grid voltage (ac)	$U_{g1\,m}$	140	140	130	V
Anode current (dc)	I_A	2,9	2,5	2,3	A
Screen grid current (dc)	I_{G2}	130	120	120	mA
Control grid current (dc)	I_{G1}	70	40	10	mA
Anode input power	P_{BA}	17,5	22,7	16	kW
Drive power	P_1	9,0 [2]	6 + 260 [3]	1 + 230 [3]	W [1]
Anode dissipation	P_A	6,5	7,7	5,2	kW
Screen grid dissipation	P_{G2}	104	96	110	W
Control grid dissipation	P_{G1}	1,0	1,0	0,1	W
Efficiency	η	63	66	68	%

I Grounded cathode circuit
II Grounded control-grid screen grid circuit

1) Circuit losses are not included.
2) Necessary output power of driver stage approx. 175 W at 60 Ω damping of input circuit and neutralization.
3) Power transition of grounded control-grid screen-grid circuit.
4) For zero signal dc anode current approx. 0,2 A.
5) Higher max. ratings may be released upon request.

Anode and screen grid modulation, class C operation, grounded cathode circuit

Maximum ratings

Frequency		f	30	MHz
Anode voltage (dc)		U_A	6,0	kV
Screen grid voltage (dc)		U_{G2}	750	V
Control grid voltage (dc)		U_{G1}	– 250	V
Cathode current (dc)		I_K	4,0	A
Peak cathode current		$I_{K\,M}$	35	A
Anode dissipation	(RS 2012 CL)	P_A	12	kW
Anode dissipation	(RS 2012 CJ)	P_A	18	kW 6)
Screen grid dissipation		P_{G2}	200	W
Control grid dissipation		P_{G1}	70	W

Operating characteristics

Frequency	f	≤ 30	≤ 30	MHz
Carrier power	P_{trg}	12	6,0	kW 1)
Anode voltage (dc)	U_A	6,0	5,0	kV
Screen grid voltage (dc)	U_{G2}	700	500	V
Control grid bias (dc), fixed	$U_{G1\,fix}$	– 90	– 70	V
Control grid resistance	R_{G1}	500	470	Ω
Control grid voltage (dc)	U_{G1}	– 220	– 150	V
Peak control grid voltage (ac)	$U_{g1\,m}$	280	190	V
Anode current (dc)	I_A	2,4	1,45	A
Screen grid current (dc)	I_{G2}	200	120	mA
Control grid current (dc)	I_{G1}	260	170	mA
Anode input power	$P_{B\,A}$	14,4	7,3	kW
Drive power	P_1	64	30	W 1)
Anode dissipation	P_A	2,4	1,3	kW 2)
Screen grid dissipation	P_{G2}	140	60	W
Control grid dissipation	P_{G1}	7,0	5,0	W
Efficiency	η	83	82	%
Anode load resistance	R_A	1,2	1,7	kΩ
Modulation factor	m	100	100	%
Peak screen grid voltage (ac)	$U_{g2\,m}$	600	350	V 3)
Modulation power	P_{mod}	7,2	3,7	kW
Control grid current (dc)	I_{G1}	400	240	mA 4)
Drive power	P_1	100	40	W 1) 4)
Anode dissipation at modulation	$P_{A\,mod}$	3,6	2,0	kW 5)
Screen grid dissipation at modulation	$P_{G2\,mod}$	170	75	W 5)

1) Circuit losses are not included.
2) Even during modulation the indicated maximum ratings must not be exceeded. It has to be observed that during 100 % modulation the anode dissipation increases to about 1,5 times the power dissipation stated for the carrier value.
3) Modulation of screen grid via separate transformer winding.
4) Maximum values at $U_A = 0$ V.
5) Average values at $m = 100$ %.
6) Higher max. ratings may be released upon request.

AF amplifier and modulator,
class B operation, 2 tubes in push-pull circuit, I_{G1} = 0

Maximum ratings

Anode voltage (dc)		U_A	7,0	kV
Screen grid voltage (dc)		U_{G2}	1100	V
Control grid voltage (dc)		U_{G1}	– 200	V
Cathode current (dc)		I_K	4,0	A
Peak cathode current		I_{KM}	35	A
Anode dissipation	(RS 2012 CL)	P_A	12	kW
Anode dissipation	(RS 2012 CJ)	P_A	18	kW [1])
Screen grid dissipation		P_{G2}	200	W
Control grid dissipation		P_{G1}	70	W

Operating characteristics at modulator operation for

		20 kW carrier power		10 kW carrier power		
Output power	P_2	0	16	0	8	kW
Anode voltage (dc)	U_A	6	6	5	5	kV
Screen grid voltage (dc)	U_{G2}	1000	1000	800	800	V
Control grid voltage (dc)	U_{G1}	– 130	– 130	– 110	– 110	V
Peak control grid voltage (ac) between 2 tubes	$U_{gg\,m}$	0	220	0	180	V
Anode current (dc)	I_A	2 × 0,5	2 × 2,4	2 × 0,3	2 × 1,5	A
Screen grid current (dc)	I_{G2}	0	2 × 90	0	2 × 30	mA
Anode input power	P_{BA}	2 × 3	2 × 14,4	2 × 1,5	2 × 7,5	kW
Anode dissipation	P_A	2 × 3	2 × 6,4	2 × 1,5	2 × 3,5	kW
Screen grid dissipation	P_{G2}	0	2 × 90	0	2 × 24	W
Efficiency	η	–	55	–	54	%
Effective load resistance (anode to anode)	R_{AA}	–	2000	–	3000	Ω

1) Higher max. ratings may be released upon request.

RF linear amplifier,
single-sideband modulation, grounded cathode circuit, $I_{G1} = 0$

Maximum ratings

Frequency		f	30	MHz
Anode voltage (dc)		U_A	9,0	kV
Screen grid voltage (dc)		U_{G2}	1000	V
Control grid voltage (dc)		U_{G1}	– 250	V
Cathode current (dc)		I_K	6,0	A
Peak cathode current		I_{KM}	35	A
Anode dissipation	(RS 2012 CL)	P_A	12	kW
Anode dissipation	(RS 2012 CJ)	P_A	18	kW [4]
Screen grid dissipation		P_{G2}	200	W
Control grid dissipation		P_{G1}	70	W

Operating characteristics

		I	II [1]	III [1]	
Frequency	f	≤ 30	≤ 30	≤ 30	MHz
Output power	P_2	0	11	5,5	kW [2]
Anode voltage (dc)	U_A	8,0	8,0	8,0	kV
Screen grid voltage (dc)	U_{G2}	900	900	900	V
Control grid voltage (dc)	U_{G1}	– 115	– 115	– 115	V
Peak control grid voltage (ac)	$U_{g1\,m}$	0	100	100	V
Anode current (dc)	I_A	1,0	2,2	1,6	A
Screen grid current (dc)	I_{G2}	0	90	30	mA
Anode input power	P_{BA}	8,0	17,6	12,8	kW
Anode dissipation	P_A	8,0	6,6	7,3	kW
Screen grid dissipation	P_{G2}	0	81	27	W
Efficiency	η	–	62,5	43	%
Third order intermodulation product	d_3	–	–	≥ 38	dB [3]
Fifth order intermodulation product	d_5	–	–	≥ 50	dB [3]

I No modulation
II 1-tone modulation
III 2-tone modulation

1) Carrier suppressed.
2) Circuit losses are not included.
3) Level of non-linear cross talk resulting from third and fifth order intermodulation products as measured by the 2-tone method at f = 30 MHz and 60 Ω input resistance (see also the diagram 'cross-talk values versus output power', page 181).
4) Higher max. ratings may be released upon request.

VX

Tube mounting

Axis vertical, anode up or down.

The tube has to be connected by means of the header sockets RöKpf212 and RöKpf212K, in which the terminal anodes for cathode, control grid, and screen grid contacts are combined to a unit and provided with spring-finger contacts.

Maximum tube surface temperature

The temperature of the metal-ceramic seals must not exceed 220 °C at any point and the temperature of the internal cathode terminal must not exceed 250 °C. In the forced-air-cooled version these requirements can be met without additional cooling, if an appropriate air duct and sufficient space between the individual contact springs is provided so that enough cooling air can pass through.

For the water-cooled version of the tube with integrated cooling jacket, a cooling air flow rate of approx. 0,3 m^3/min at a static pressure of approx. 1 mbar is required on the terminal side.

Forced-air cooling (RS 2012 CL)

The minimum air flow rate required for the maximum anode dissipation is given in the cooling air diagram, valid for 25 °C inlet temperature at a normal air pressure of 1 bar (sea level). The cooling air is supplied from the electrode terminal side. For further information on forced-air-cooling refer to “Explanations on Technical Data”.

Water cooling (RS 2012 CJ)

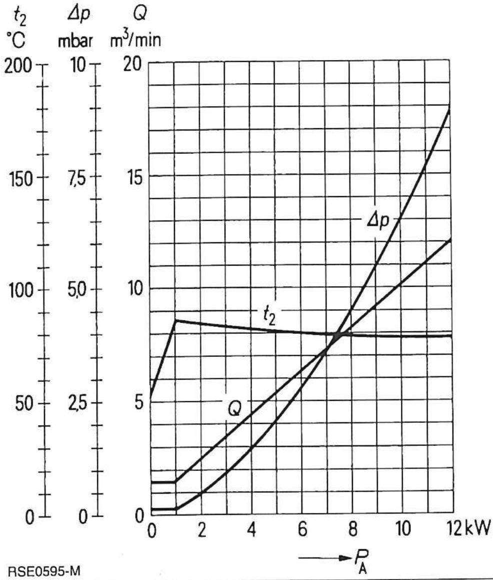
The cooling water diagrams are valid for water inlet temperatures of 35 °C and 50 °C. For other water inlet temperatures within this range the required water flow rate can be calculated by linear interpolation. The pressure of the cooling water must not exceed 6 bar. Please observe the instructions on water cooling given under “Explanations on Technical Data”.

Safety precautions

The section “Safety precautions” under “Explanations on Technical Data” describes how the tube is to be protected against damage due to electric overload or insufficient cooling. A copper wire with 0,20 mm diameter should be used to test the anode overcurrent trip circuit.

The tube fuse RöSich7 is recommended for protecting the forced-air-cooled version RS 2012 CL against thermal anode overload. In conjunction with pull switch RöKt11 it disconnects the voltages at the tube in case of overload (see accessories).

Cooling air diagram (RS 2012 CL)

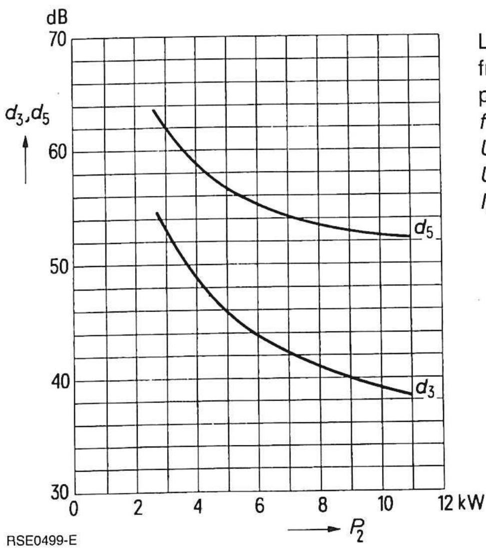


RSE0595-M

The cooling air is supplied from the electrode terminal side.

Air pressure = 1 bar
t_1 = 25 °C

Intermodulation products

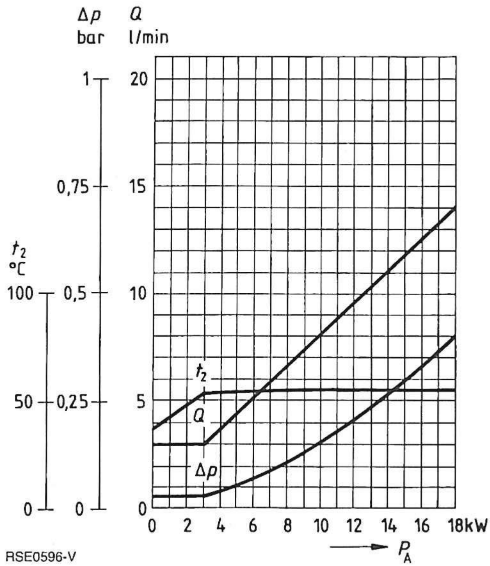


RSE0499-E

Maximum output at 2-tone modulation (PEP)

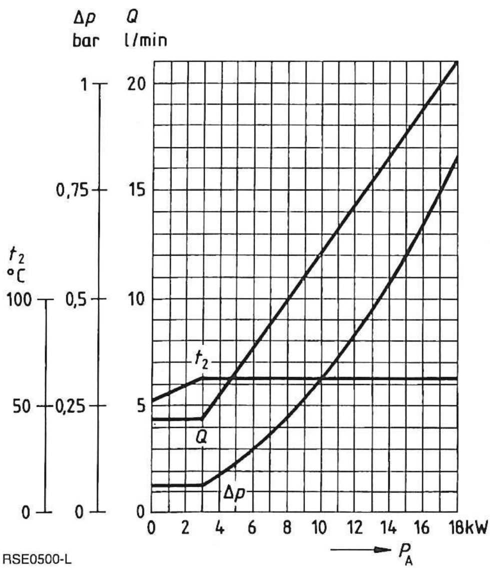
Level of non-linear cross talk resulting from third and fifth order intermodulation products as measured by the 2-tone method at
f = 30 MHz,
U_A = 8 kV,
U_{G2} = 900 V,
I_{A0} = 1 A.

Cooling water diagrams (RS 2012 CJ)



t_1 = 35 °C

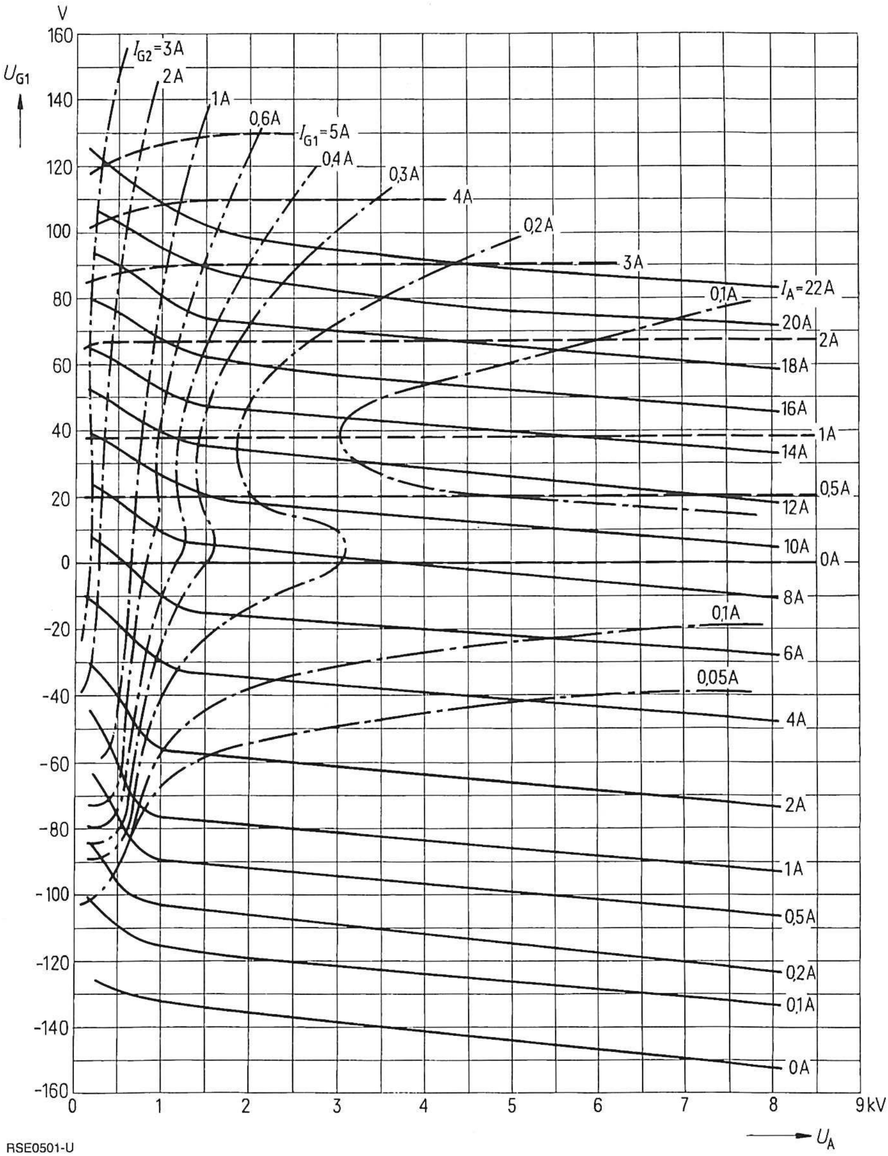
RSE0596-V



t_1 = 50 °C

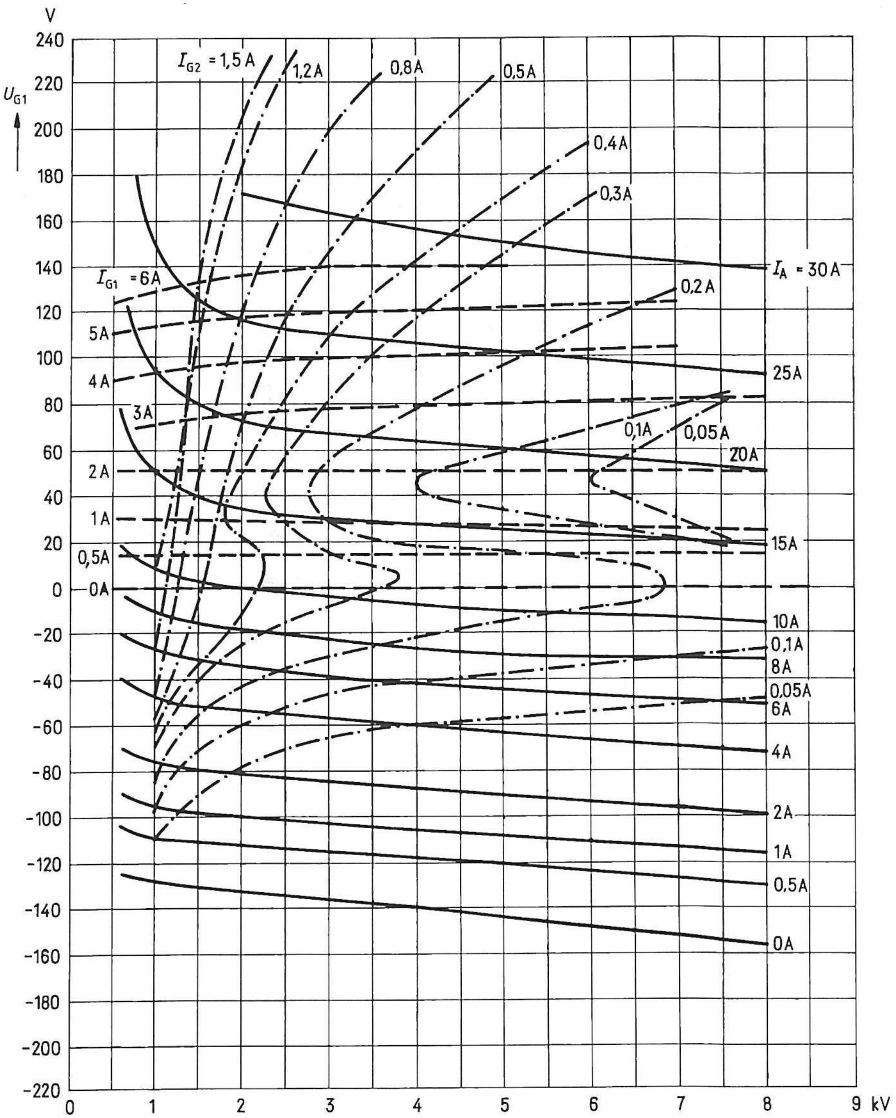
RSE0500-L

$U_{G1} = f(U_A)$ Parameter = I_A ———————
$U_{G2} = 800$ V Parameter = I_{G2} —·—·—·—
Parameter = I_{G1} — — — — — —



RSE0501-U

$U_{G1} = f(U_A)$ Parameter = I_A ———————
$U_{G2} = 1000$ V Parameter = I_{G2} —·—·—·—·—
Parameter = I_{G1} — — — — — —

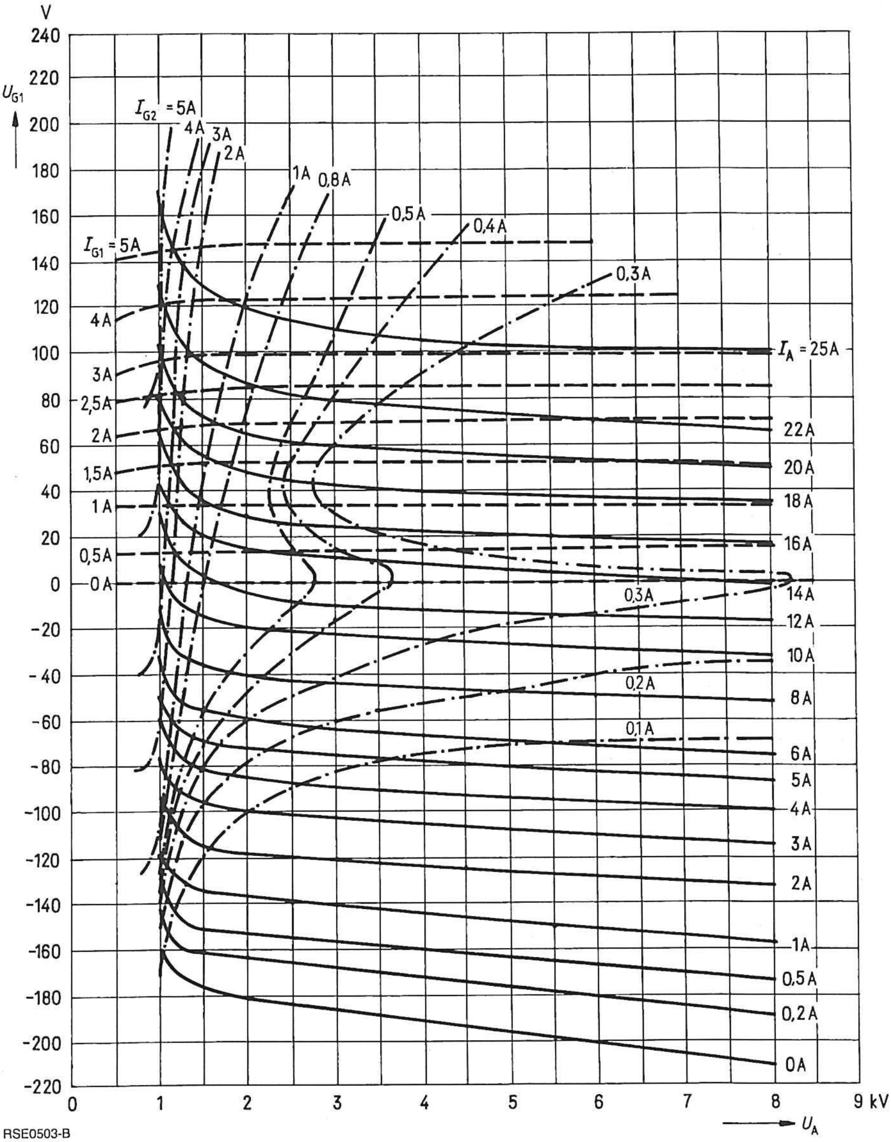


RSE0502-3

$U_{G1} = f(U_A)$ Parameter = I_A ————————

$U_{G2} = 1200$ V Parameter = I_{G2} —·—·—·—

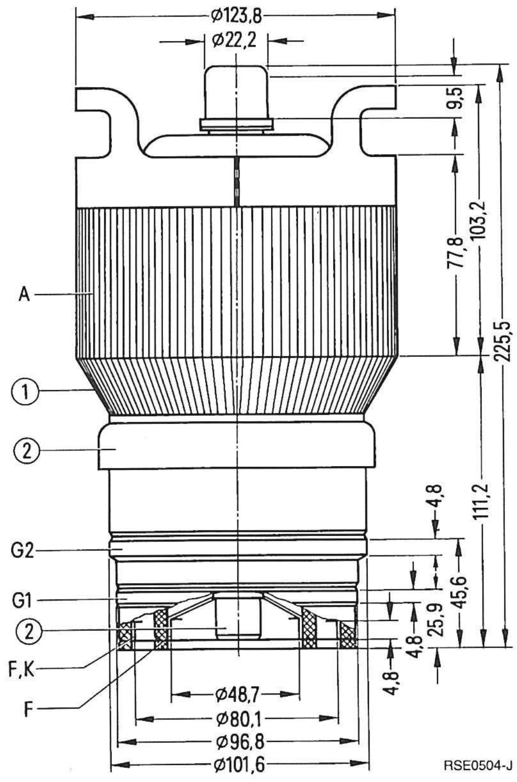
Parameter = I_{G1} — — — — —



RSE0503-B

Especially for communications transmitters, P_2 approx. 10 kW Ordering code Q51-X2014

Coaxial metal-ceramic tetrode for frequencies up to 110 MHz, forced-air-cooled; particularly suitable for use as RF amplifier, AF amplifier and linear amplifier in single-sideband transmitters.



Dimensions in mm

① Air inlet
② Do not use as terminal

Approx. weight 4,3 kg

Heating

Heater voltage	U_F	7,5	V
Heater current	I_F	≈ 78	A
Heating: direct			
Cathode: thoriated tungsten			

Characteristics

Amplification factor of screen grid	μ_{g2g1}	4,5	
Transconductance at $U_A = 3$ kV, $U_{G2} = 750$ V, $I_A = 0{,}9$ to $1{,}2$ A	S	21	mA/V

Capacitances

Cathode/control grid, screen grid	$c_{k/g1g2}$	≈ 47	pF
Control grid/screen grid, cathode	$c_{g1/g2k}$	≈ 106	pF
Anode/cathode	c_{ak}	≈ 0,14	pF [1])
Anode/control grid	c_{ag1}	≈ 0,75	pF [1])
Anode/screen grid, cathode	$c_{a/g2k}$	≈ 18	pF
Anode/control grid, screen grid, cathode	$c_{a/g1g2k}$	≈ 18	pF

Accessories

		Ordering code
Header socket	RöFsg2793	Q81-X28
Air duct	RöAnst214	Q81-X826

1) Measured by means of a 30 cm diameter screening plate in the screen grid terminal plane.

RF amplifier,
class C operation

Maximum ratings

Frequency	f	30	60	110	MHz
Anode voltage (dc)	U_A	7,5	7,0	6,5	kV
Screen grid voltage (dc)	U_{G2}	1500	1500	1500	V
Anode current (dc)	I_A	3,0	2,8	2,6	A
Anode dissipation	P_A	5,0	5,0	5,0	kW
Screen grid dissipation	P_{G2}	250	250	250	W
Control grid dissipation	P_{G1}	75	75	75	W

Operating characteristics

Frequency	f	≤ 30	≤ 110	MHz
Output power	P_2	16	10	kW [1])
Anode voltage (dc)	U_A	7,5	6,5	kV
Screen grid voltage (dc)	U_{G2}	500	750	V
Control grid voltage (dc)	U_{G1}	– 350	– 350	V
Peak control grid voltage (ac)	$U_{g1\,m}$	590	430	V
Anode current (dc)	I_A	2,8	2,3	A
Screen grid current (dc)	I_{G2}	0,50	0,20	A
Control grid current (dc)	I_{G1}	0,25	0,05	A
Anode input power	$P_{B\,A}$	21	15	kW
Drive power	P_1	150	25	W [1])
Anode dissipation	P_A	5,0	5,0	kW
Efficiency	η	77	67	%

1) Circuit losses are not included.

Anode and screen grid modulation, class C operation, grounded cathode circuit

Maximum ratings

Frequency	f	30	MHz
Anode voltage (dc)	U_A	5,5	kV
Screen grid voltage (dc)	U_{G2}	1000	V
Anode current (dc)	I_A	2,5	A
Anode dissipation	P_A	6,0	kW
Screen grid dissipation	P_{G2}	250	W
Control grid dissipation	P_{G1}	75	W

Operating characteristics

Frequency	f	≤ 30	MHz
Carrier power	P_{trg}	5,8	kW [1])
Anode voltage (dc)	U_A	5,0	kV
Screen grid voltage (dc)	U_{G2}	500	V
Control grid voltage (dc)	U_{G1}	– 400	V
Peak control grid voltage (ac)	$U_{g1\,m}$	520	V
Anode current (dc)	I_A	1,4	A
Screen grid current (dc)	I_{G2}	0,26	A
Control grid current (dc)	I_{G1}	0,05	A
Drive power	P_1	25	W [1])
Anode dissipation	P_A	1,1	kW [2])
Modulation factor	m	100	%
Peak screen grid voltage (ac)	$U_{g2\,m}$	450	V
Anode dissipation during modulation	$P_{A\,mod}$	1,7	kW

1) Circuit losses are not included.
2) Even during modulation the indicated maximum ratings must not be exceeded. It must be observed that during 100 % modulation the anode dissipation increases to about 1,5 times the power dissipation stated for the carrier value.

AF amplifier and modulator, class B operation, 2 tubes in push-pull circuit, $I_{G1} = 0$

Maximum ratings

Anode voltage (dc)	U_A	7,5	kV
Screen grid voltage (dc)	U_{G2}	1500	V
Anode current (dc)	I_A	4,0	A
Anode dissipation	P_A	6,0	kW
Screen grid dissipation	P_{G2}	250	W
Control grid dissipation	P_{G1}	75	W

Operating characteristics

Output power	P_2	11,5	13,5	17	17,5	kW
Anode voltage (dc)	U_A	4,0	5,0	6,0	7,0	kV
Screen grid voltage (dc)	U_{G2}	1250	1250	1250	1250	V
Control grid voltage (dc)	U_{G1}	– 270	– 280	– 310	– 325	V
Peak control grid voltage (ac) between the 2 tubes	$U_{gg\,m}$	500	480	540	470	V
Anode current (dc)	I_A	2 × 2,55	2 × 2,20	2 × 2,10	2 × 1,80	A
Zero signal anode current (dc)	$I_{A\,0}$	2 × 0,75	2 × 0,50	2 × 0,41	2 × 0,35	A
Screen grid current (dc)	I_{G2}	2 × 0,17	2 × 0,16	2 × 0,15	2 × 0,12	A
Anode dissipation	P_A	2 × 4,20	2 × 4,20	2 × 4,20	2 × 4,20	kW
Effective load resistance (anode to anode)	R_{AA}	1500	2370	2940	4100	Ω

Tube mounting

Axis vertical, anode up or down.

The header socket RöFsg2793 as listed under "Accessories" should be used for connection of cathode and grid.

The air duct RöAnst214 is intended to support the cooling of the electrode terminals.

Maximum tube surface temperature

The temperature of the ceramic-metal parts must not exceed 250 °C at any point.

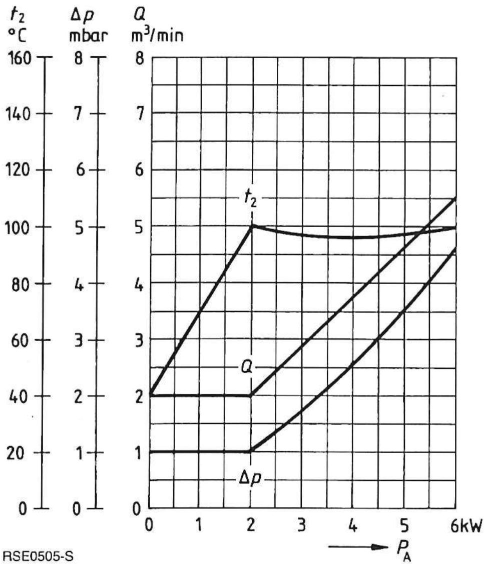
Forced-air cooling

The cooling air diagram is valid for frequencies up to 30 MHz at an air inlet temperature of 25 °C and a normal air pressure of 1 bar. The cooling air on the anode radiator must be supplied via the recommended air duct (accessories) from the side of the electrode terminals.

Safety precautions

The section "Safety precautions" under "Explanations on Technical Data" describes how the tube is to be protected against damage due to electric overload or insufficient cooling. A copper wire with 0,20 mm diameter should be used to test the anode overcurrent trip circuit.

Cooling air diagram



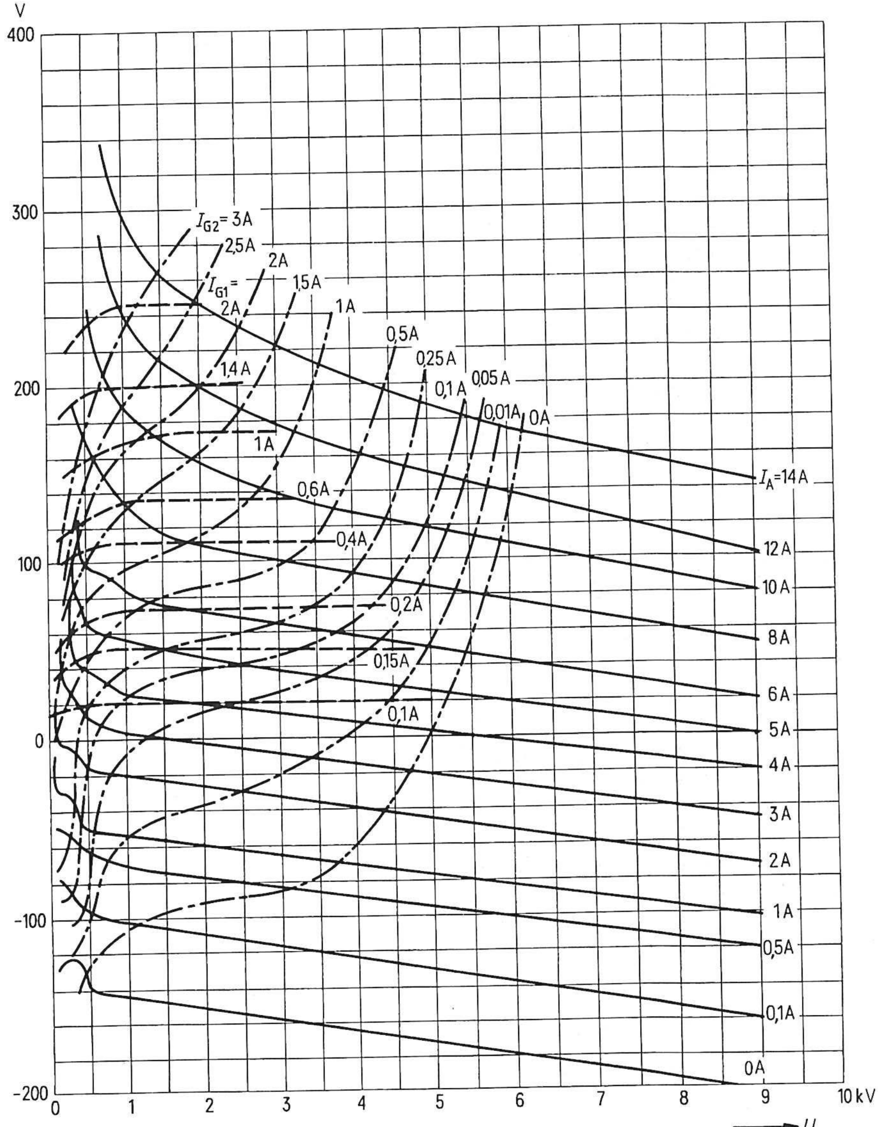
RSE0505-S

The cooling air is supplied from the electrode terminal side.

Air pressure = 1 bar
t_1 = 25 °C

$U_{G1} = f(U_A)$
$U_{G2} = 500$ V

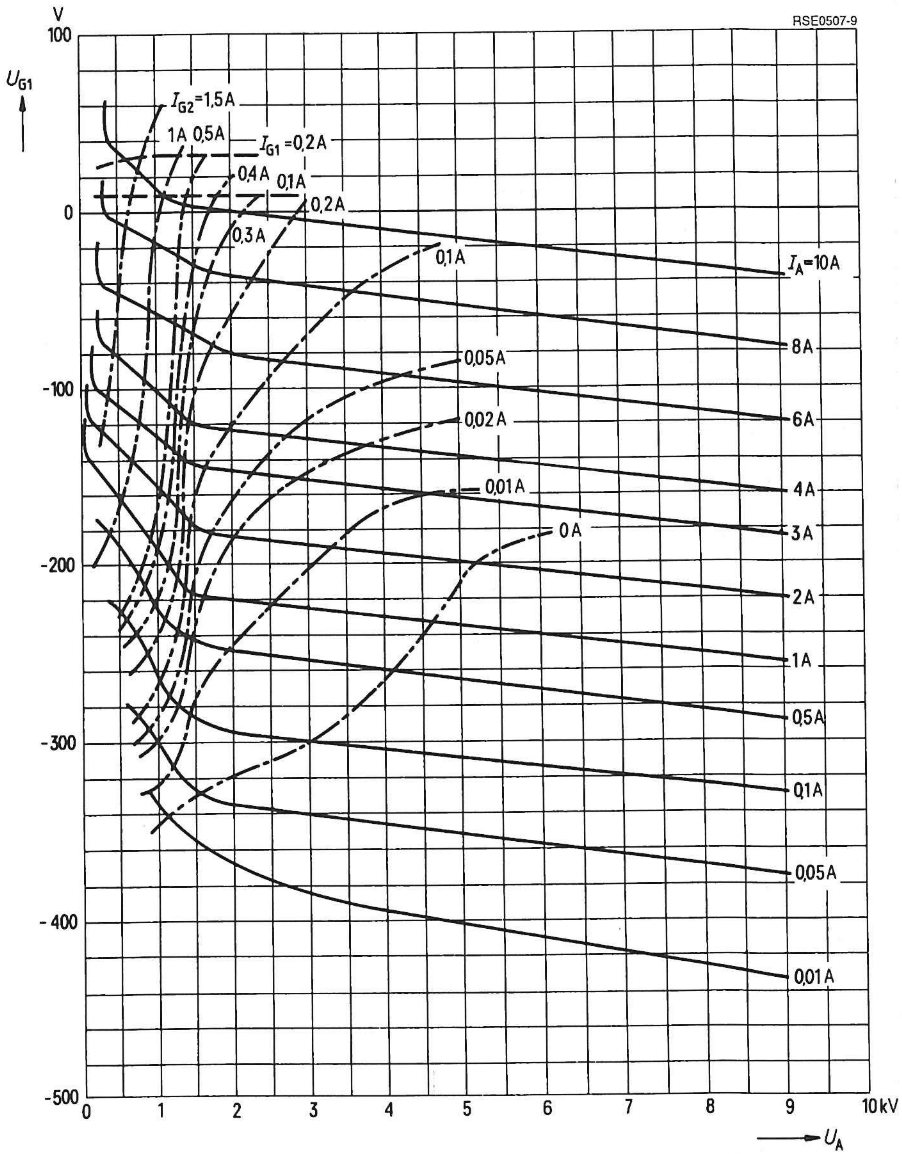
Parameter = I_A ————————
Parameter = I_{G2} —·—·—·—·—
Parameter = I_{G1} — — — — — —



RSE0506-1

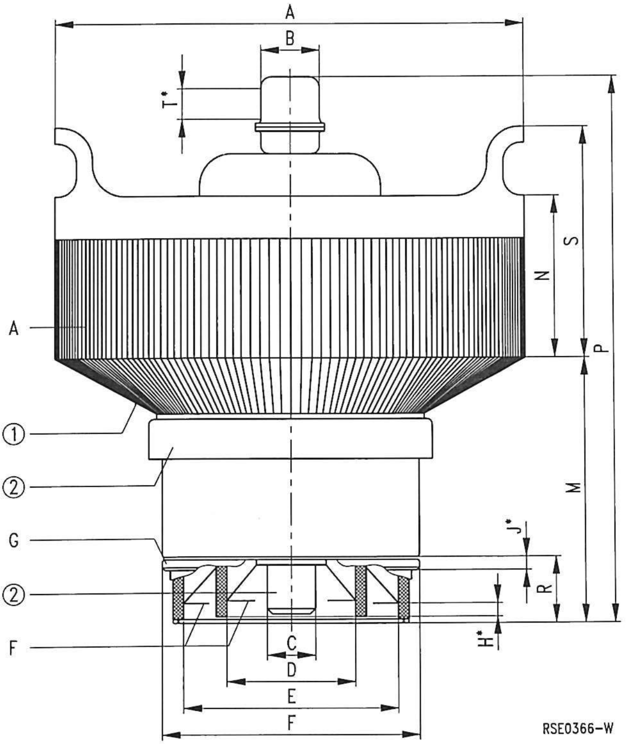
$U_{G1} = f(U_A)$
$U_{G2} = 1250$ V

Parameter = I_A ————————
Parameter = I_{G2} —·—·—·—·—
Parameter = I_{G1} — — — — — —



Ordering code Q51-X701

Coaxial metal-ceramic power triode, forced-air-cooled, intended to be used as a zero-bias class-B amplifier in audio or radio-frequency applications up to 25 kW power output.



Dimensional data

	min	max
A	175,97	179,07
B	21,72	25,49
C	18,29	19,30
D	48,16	49,17
E	79,58	80,59
F	96,32	97,33
H	4,77	
J	4,77	
M	100,33	109,22
N	61,26	70,81
P	209,55	222,25
R	25,04	26,67
S	86,66	96,21
T	9,52	

Dimensions in mm

① Air inlet
② Do not use as terminal

Approx. weight 5,5 kg

Heating

Heater voltage	U_F	7,5	V
Heater current	I_F	≈ 100	A
Heating: direct			
Cathode: thoriated tungsten			

Characteristics

Transconductance at U_A = 5 kV, I_A = 5 A	s	55	mA/V

Capacitances

Cathode/grid	c_{kg}	≈ 59	pF
Cathode/anode	c_{ka}	≈ 0,2	pF
Grid/anode	c_{ga}	≈ 36	pF

Accessories		Ordering code
Socket	RöFsg215	Q81-X641
Air duct	RöAnst215	Q81-X633

Anode modulation, class C operation

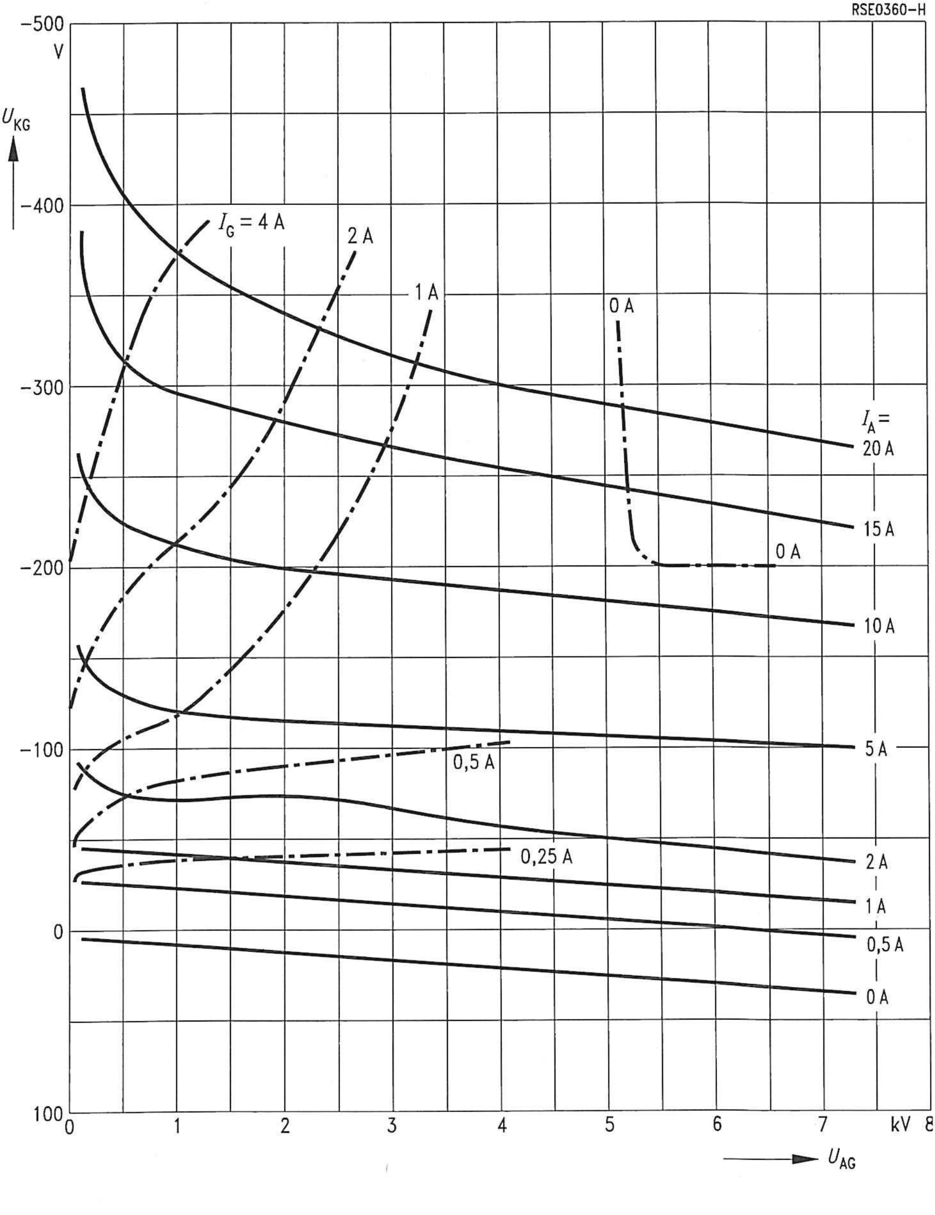
Maximum ratings

Frequency	f	160	MHz
Anode voltage (dc)	U_A	6,5	kV
Grid voltage (dc)	U_G	– 500	V
Anode current (dc)	I_A	3,0	A
Anode dissipation	P_A	10	kW
Grid dissipation	P_G	500	W

Operating characteristics

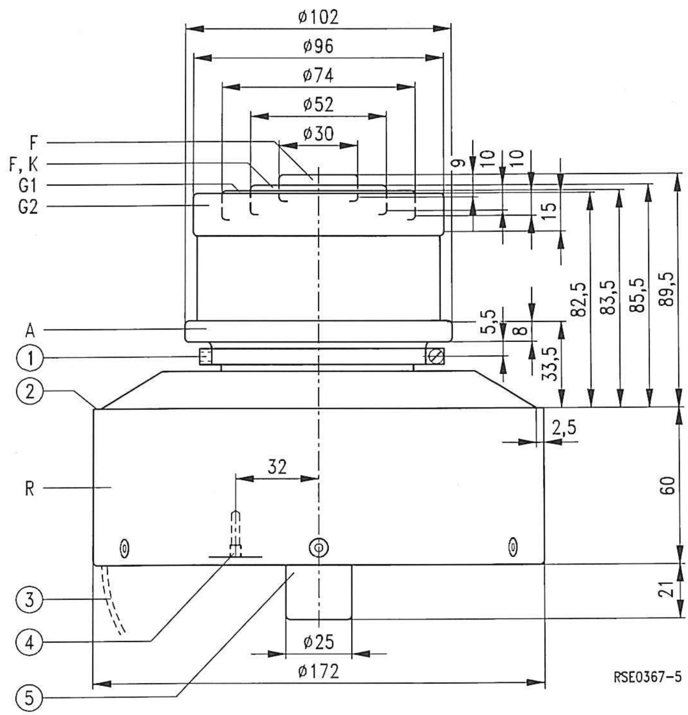
Frequency	f	≤ 30	MHz
Carrier power	P_{trg}	11,9	kW
Anode voltage (dc)	U_A	5,0	kV
Grid bias (dc)	U_G	– 200	V
Peak grid voltage (ac)	$U_{g\,m}$	490	V
Anode current (dc)	I_A	3,0	A
Grid current (dc)	I_G	0,8	A
Anode input power	$P_{B\,A}$	15	kW
Drive power	P_1	380	W
Anode dissipation	P_A	3,1	kW
Grid dissipation	P_G	220	W
Efficiency	η	79	%
Anode load resistance	R_A	825	Ω

$U_{KG} = f(U_{AG})$ Parameter = I_A ———
Parameter = I_G —·—·—



Ordering code Q51-X2016

Coaxial metal-ceramic tetrode, forced-air-cooled, for frequencies up to 300 MHz. Due to the low feedback capacitance c_{g1a} the tube is also suitable for use in grounded cathode circuit. To achieve a long service life, the cathode is especially designed for operation with controlled heating power .



Dimensions in mm

① Taphole M4 for tube fuse RöSich10
② Free for anode support
③ Handle, swingable
④ Taphole for tube fuse RöSich7
⑤ Do not use as terminal

Approx. weight 6,7 kg

The radiator and the terminals are of concentric design with the following diameters:

Radiator	Ø 173,5	Control grid terminal	Ø 75,0
Anode terminal	Ø 103,0	Heater/cathode terminal	Ø 52,6
Screen grid terminal	Ø 97,0	Heater terminal	Ø 30,6

Heating

Heater voltage	U_F	9,5	V
Heater current	I_F	≈ 80	A
Heating: direct			
Cathode: thoriated tungsten			

Kennwerte

Emission current at $U_A = U_{G2} = U_{G1} = 300$ V	I_{em}	35	A
Amplification factor of screen grid at $U_A = 2$ kV, $U_{G2} = 600$ to 1000V, $I_A = 2$ A	μ_{g2g1}	8,0	
Transconductance at $U_A = 2$ kV, $U_{G2} = 800$ V, $I_A = 1{,}5$ to 2,5 A	s	53	mA/V

Capacitances

Cathode/control grid	c_{kg1}	≈ 78	pF
Cathode/screen grid	c_{kg2}	≈ 5,5	pF
Cathode/anode	c_{ka}	≈ 0,04	pF [1])
Control grid/screen grid	c_{g1g2}	≈ 115	pF
Control grid/anode	c_{g1a}	≈ 0,32	pF [1])
Screen grid/anode	c_{g2a}	≈ 22	pF

Accessories

		Ordering code
Socket wrench for tube fuse	RöZub09	Q81-X2109
Socket wrench for tube fuse	RöZub10	Q81-X2110
Tube fuse	RöSich7	Q81-X1407
Tube fuse	RöSich10	Q81-X1410
Pull switch for tube fuse	RöKt11	Q81-X1311
Spring-finger contacts:		
Internal cathode terminal		C65055-A815-C901
External cathode terminal		C65055-A815-C902
Control grid terminal		C65055-A815-C903
Screen grid terminal		C65055-A815-C904

1) Measured by means of a 50 cm diameter screening plate in the screen-grid terminal plane.

RF amplifier, class B operation, grounded cathode circuit

Maximum ratings

Frequency	f	110	MHz
Anode voltage (dc)	U_A	9,0	kV
Screen grid voltage (dc)	U_{G2}	1000	V
Control grid voltage (dc)	U_{G1}	– 250	V
Cathode current (dc)	I_K	6,0	A
Peak cathode current	$I_{K\,M}$	35	A
Anode dissipation	P_A	12	kW
Screen grid dissipation	P_{G2}	270	W
Control grid dissipation	P_{G1}	70	W

Operating characteristics

Frequency	f	≤ 110	MHz
Output power	P_2	12	kW [1])
Anode voltage (dc)	U_A	7,5	kV
Screen grid voltage (dc)	U_{G2}	800	V
Control grid voltage (dc)	U_{G1}	– 100	V [2])
Peak control grid voltage (ac)	$U_{g1\,m}$	110	V
Anode current (dc)	I_A	2,3	A
Screen grid current (dc)	I_{G2}	200	mA
Control grid current (dc)	I_{G1}	50	mA
Anode input power	$P_{B\,A}$	17,2	kW
Drive power	P_1	5,0	W [3])
Anode dissipation	P_A	5,2	kW
Screen grid dissipation	P_{G2}	160	W
Efficiency	η	70	%
Anode load resistance	R_A	1800	Ω

1) Circuit losses are not included.
2) For zero signal dc anode current $I_{A\,0}$ = 0,4 A.
3) Additional loss in the grid circuit is not taken into consideration.

Tube mounting

Axis vertical, anode up or down.

Spring-finger contacts can be ordered for cavity design (accessories).

Maximum tube surface temperature

The temperature of the tube's metal-ceramic seals must not exceed 220 °C at any point and the temperature of the internal cathode terminal must not exceed 250 °C. These requirements can be met without additional cooling of the terminals if an appropriate air duct and sufficient space between the individual contact springs is provided so that enough cooling air can pass through.

Forced-air cooling

The minimum air flow rate required for maximum anode dissipation is given in the cooling air diagram valid for 25 °C inlet temperature at a normal air pressure of 1 bar (sea level). The cooling air must be supplied from the side of the electrode terminals. For further information on forced-air cooling refer to "Explanations on Technical Data".

Safety precautions

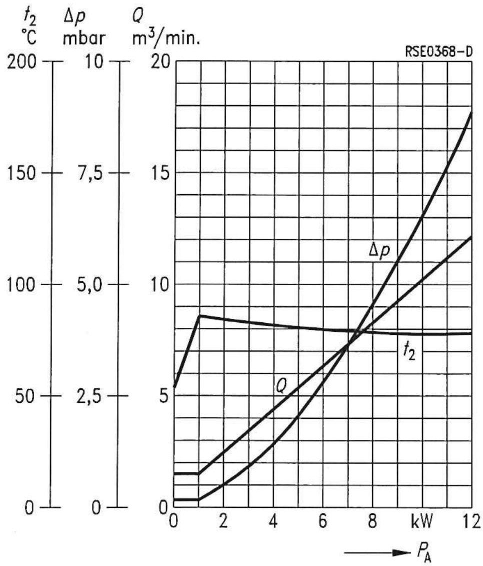
The section "Safety precautions" under "Explanations on Technical Data" describes how the tube is to be protected against damage due to electric overload or insufficient cooling. A copper wire with 0,20 mm diameter should be used to test the anode overcurrent trip circuit.

For protection against thermal anode overload the tube fuse RöSich7/RöSich10 is recommended. In conjunction with pull switch RöKt11 it disconnects the voltages at the tube in case of overload (accessories).

Service life warranty

For higher claims under warranty concerning the guaranteed service life it has to be ensured that the tube is operated in transmitters with controlled heating power.

Cooling air diagram



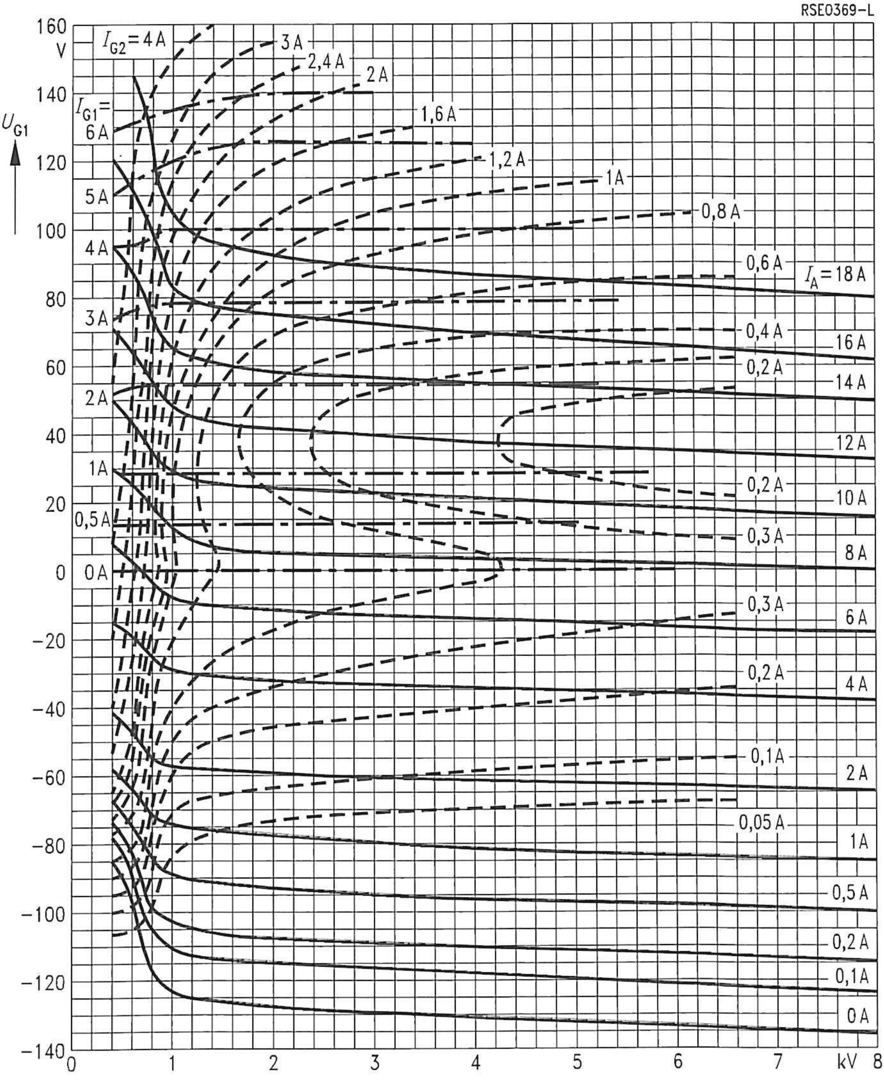
The cooling air is supplied from the electrode terminal side.

Air pressure = 1 bar

t_1 = 25 °C

$U_{G1} = f(U_A)$
$U_{G2} = 800$ V

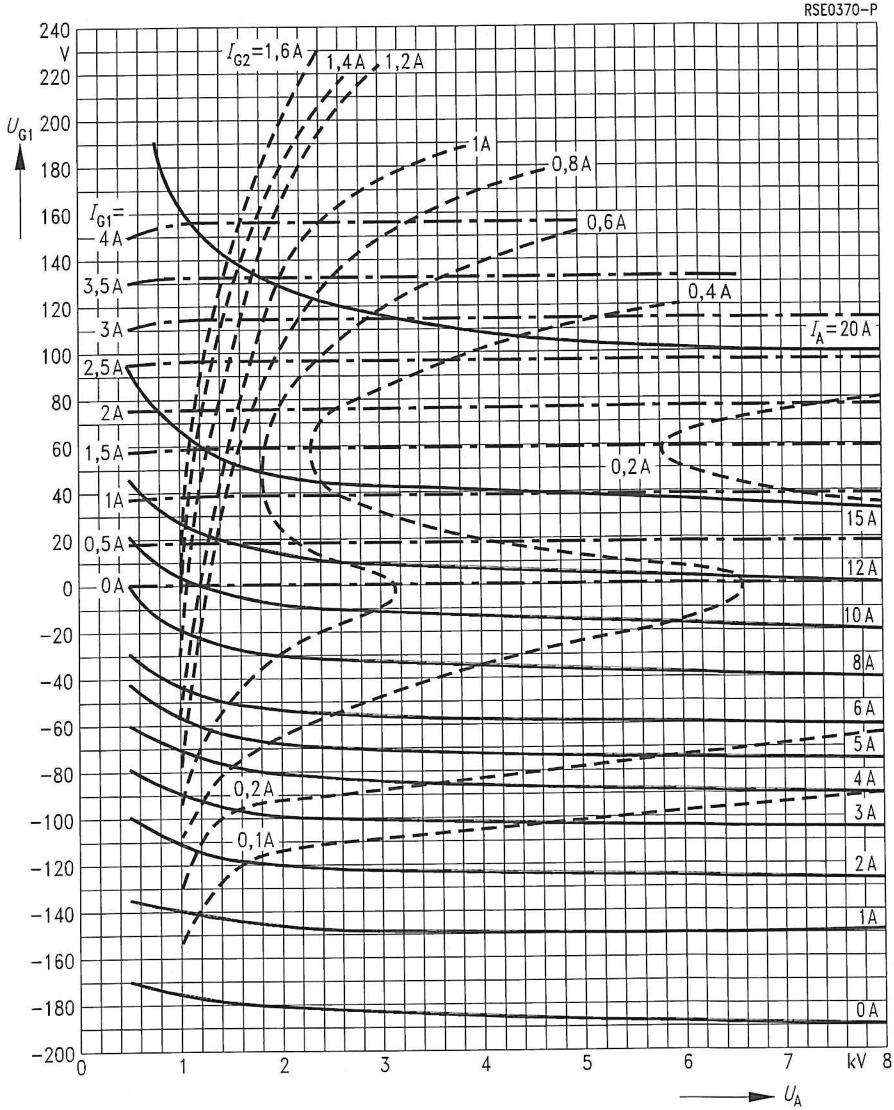
Parameter = I_A ————————
Parameter = I_{G2} — — — — — —
Parameter = I_{G1} —·—·—·—·—·—



$U_{G1} = f(U_A)$ Parameter = I_A ————————

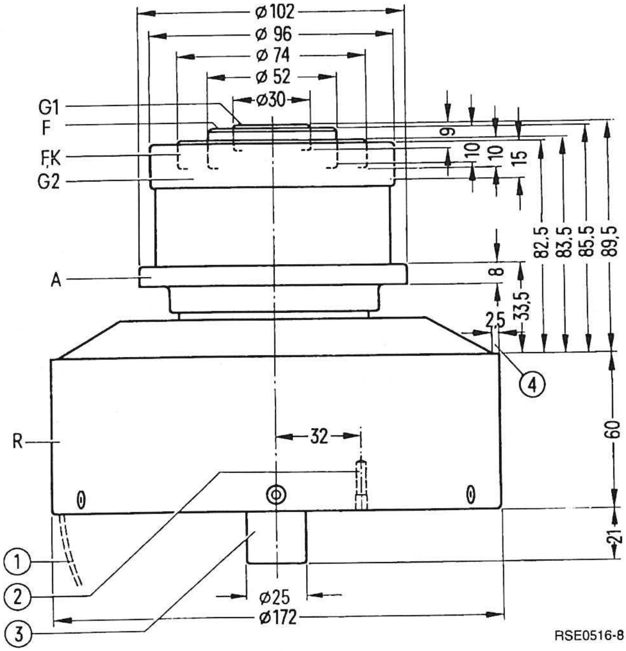
$U_{G2} = 1000$ V Parameter = I_{G2} — — — — — — —

Parameter = I_{G1} —·—·—·—·—·—·—



For FM transmitters in grounded cathode circuit Ordering code Q51-X2018

Coaxial metal-ceramic tetrode, forced-air-cooled, particularly suitable for FM transmitters in grounded cathode circuit. For an easy design of the tuned circuit the control grid terminal is coaxially led out within the cathode terminals. A direct dc blocking of the screen grid produced by the external cathode terminal is thereby possible. This arrangement of the terminals also prevents cross coupling of the input and output circuit against the common cathode line inductance. An increased stability against self-excitation has been achieved by integrating an attenuator into the screen grid line. This resistor consumes a power of approximately 30 W for an operating frequency of 110 MHz and an output power of 12 kW. To achieve a long service life, the cathode is especially designed for operation with controlled heating power.



Dimensions in mm

① Handle, swingable
② Taphole for tube fuse RöSich7
③ Do not use as terminal
④ Free for anode support

Approx. weight 6,7 kg

The radiator and the terminals are of concentric design with the following diameters:

Radiator	Ø 173,5	Control grid terminal	Ø 30,6
Anode terminal	Ø 103,0	Heater/cathode terminal	Ø 74,6
Screen grid terminal	Ø 96,6	Heater terminal	Ø 52,5

Heating

Heater voltage	U_F	9,5	V
Heater current	I_F	≈ 80	A
Heating: direct			
Cathode: thoriated tungsten			

Characteristics

Emission current at $U_A = U_{G2} = U_{G1} = 300$ V	I_{em}	35	A
Amplification factor of screen grid at $U_A = 2$ kV, $U_{G2} = 600$ to 1000V, $I_A = 2$ A	μ_{g2g1}	8,0	
Transconductance at $U_A = 2$ kV, $U_{G2} = 800$ V, $I_A = 1{,}5$ bis 2,5 A	s	53	mA/V

Capacitances

Cathode/control grid	c_{kg1}	≈ 95	pF
Cathode/screen grid	c_{kg2}	≈ 45	pF
Cathode/anode	c_{ka}	≈ 0,04	pF [1])
Control grid/screen grid	c_{g1g2}	≈ 76	pF
Control grid/anode	c_{g1a}	≈ 0,32	pF [1])
Screen grid/anode	c_{g2a}	≈ 22	pF

Accessories		**Ordering code**
Socket wrench for tube fuse	RöZub09	Q81-X2109
Tube fuse	RöSich7	Q81-X1407
Pull switch for tube fuse	RöKt11	Q81-X1311
Cavity (87 - 108 MHz), 10 kW	TK 4470	Q94-X4470

1) Measured by means of a 50 cm diameter screening plate in the screen grid terminal plane.

RF amplifier,
class B operation, grounded cathode circuit

Maximum ratings

Frequency	f	110	MHz
Anode voltage (dc)	U_A	9,0	kV
Screen grid voltage (dc)	U_{G2}	1000	V
Control grid voltage (dc)	U_{G1}	– 250	V
Cathode current (dc)	I_K	6,0	A
Peak cathode current	$I_{K\,M}$	35	A
Anode dissipation	P_A	12	kW
Screen grid dissipation	P_{G2}	270	W
Control grid dissipation	P_{G1}	70	W

Operating characteristics

Frequency	f	≤ 110	MHz
Output power	P_2	12	kW 1)
Anode voltage (dc)	U_A	7,5	kV
Screen grid voltage (dc)	U_{G2}	800	V
Control grid voltage (dc)	U_{G1}	– 100	V 2)
Peak control grid voltage (ac)	$U_{g1\,m}$	110	V
Anode current (dc)	I_A	2,3	A
Screen grid current (dc)	I_{G2}	200	mA
Control grid current (dc)	I_{G1}	50	mA
Anode input power	$P_{B\,A}$	17,2	kW
Drive power	P_1	30	W 3)
Anode dissipation	P_A	5,2	kW
Screen grid dissipation	P_{G2}	160	W
Efficiency	η	70	%
Anode load resistance	R_A	1800	Ω

1) Circuit losses are not included.
2) For zero signal dc anode current $I_{A\,0}$ = 0,4 A.
3) Drive power including internal damping losses.

Tube mounting

Axis vertical, anode up or down.

The cavity TK 4470 is available for tube operation in the VHF range (accessories).

Maximum tube surface temperature

The metal-ceramic seals of the tube must not exceed a temperature 220 °C at any point, except of the centrally located control grid terminal, the temperature of which must not exceed 280 °C. These requirements can only be met without additional cooling of the terminals if an appropriate air duct and sufficient space between the individual contact springs is provided so that enough cooling air can pass through.

Forced-air cooling

The minimum air flow rate required for maximum anode dissipation is given in the cooling air diagram valid for 25 °C inlet temperature at a normal air pressure of 1 bar (sea level). The cooling air must be supplied from the side of the electrode terminals. For further information on forced air cooling refer to "Explanations on Technical Data".

Safety precautions

The rating of the resistor that may be required in the anode circuit depends on the transmitter circuitry, the flter circuitry and the overcurrent trip circuit (e.g. an ignitron short-circuit trip or a protective spark gap RöKt2).

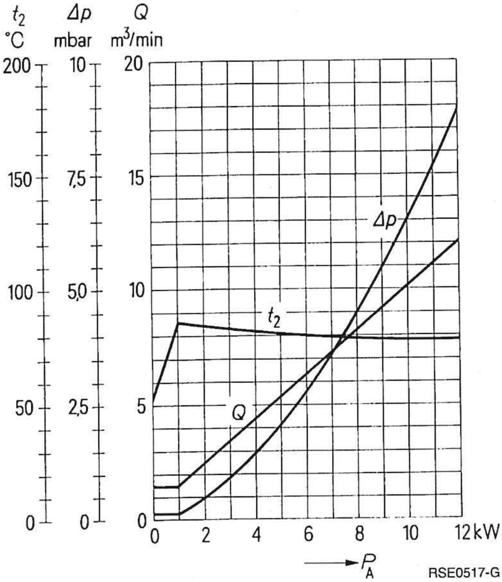
The section "Safety precautions" under "Explanations on Technical Data" describes how the tube is to be protected against damage due to electric overload or insufficient cooling. A copper wire with 0,20 mm diameter should be used to test the anode overcurrent trip circuit.

For protection against thermal anode overload the tube fuse RöSich7 is recommended. In conjunction with pull switch RöKt11 it disconnects the voltages at the tube in case of overload (accessories).

Service life warranty

For higher claims under warranty concerning the guaranteed service life it has to be ensured that the tube is operated in transmitters with controlled heating power.

Cooling air diagram



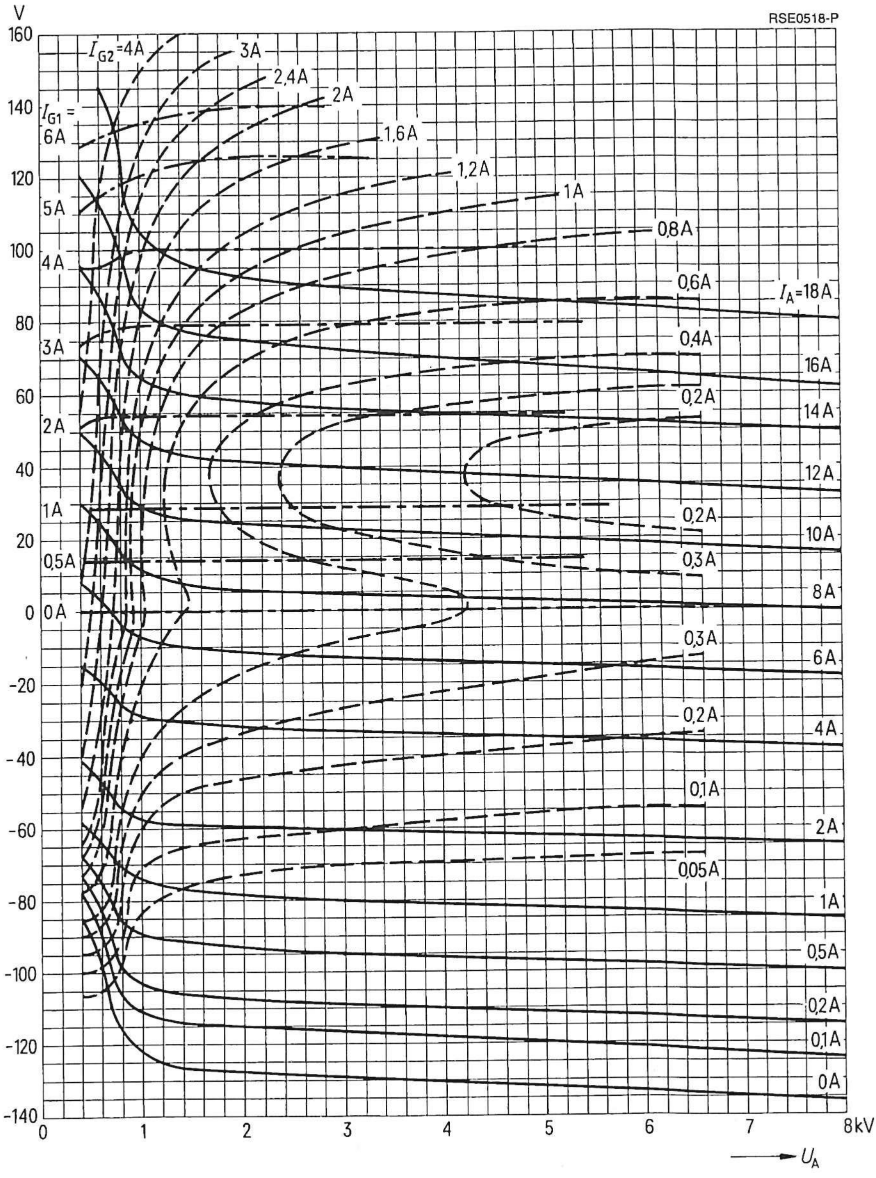
The cooling air is supplied from the electrode terminal side.

Air pressure = 1 bar

t_1 = 25°C

$U_{G1} = f(U_A)$
$U_{G2} = 800$ V

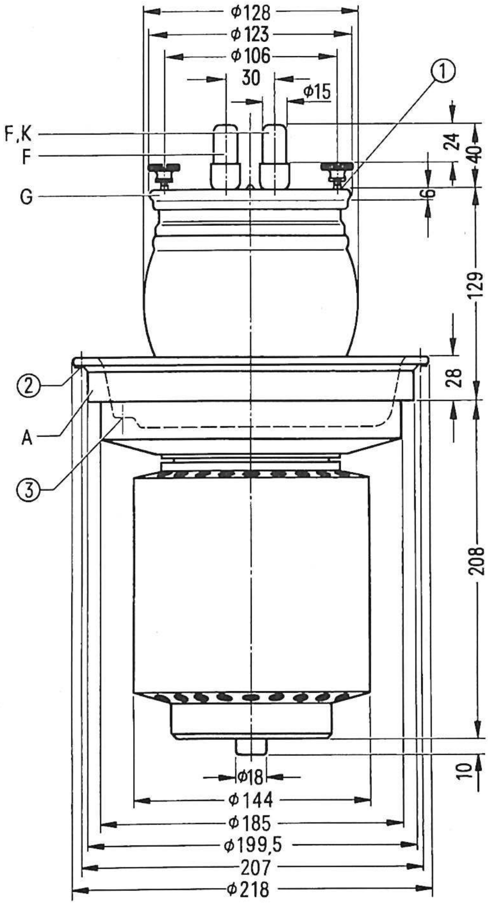
Parameter = I_A ————
Parameter = I_{G2} — — — —
Parameter = I_{G1} —·—·—·—



For frequencies up to 70 MHz

Ordering code Q53-X2021

Vapor-cooled triode with coaxial grid lead-through, suitable for use as RF amplifier, oscillator and modulator.



RSE0508-H

Dimensions in mm

① 12 tapholes M5 (12 × 30°)
② Taphole M6 for screw-in handle RöZub31V
③ Taphole M5 for tube fuse RöSich4

Approx. weight 17 kg

Transmitter Triode

Heating

Heater voltage	U_F	12,6	V
Heater current	I_F	≈ 160	A
Heating: direct			
Cathode: thoriated tungsten			

Characteristics

Emission current at $U_A = U_G = 700$ V	I_{em}	75	A
Amplification factor at $U_A = 1$ to 6 kV, $I_A = 1$ A	μ	58	
Transconductance at $U_A = 3$ kV, $I_A = 1$ A	s	60	mA/V

Capacitances

Cathode/grid	c_{kg}	≈ 120	pF
Cathode/anode	c_{ka}	≈ 1,4	pF [1)]
Grid/anode	c_{ga}	≈ 50	pF

Accessories

Accessories		Ordering code
Mounting instruction	RöMo64	
Mounting instruction	RöMo85	
Cathode connecting strip (2 for each tube)	RöKat221	Q81-X1136
Grid terminal	RöGit01	Q81-X901
Socket wrench for tube fuse	RöZub10	Q81-X2110
Handle	RöZub31V	Q81-X2133
Tube fuse	RöSich4	Q81-X1404
Pull switch for tube fuse	RöKt11	Q81-X1311
Boiler	RöKüV221	Q81-X1681
Insulating pipe at water inlet	RöKüV31Zub4	Q81-X1634
Union at water inlet	RöKüV31Zub7	Q81-X1637
Insulating pipe at vapor outlet	RöKüV201Zub3	Q81-X1673
Gasket at vapor outlet	RöKüV201Zub8	Q81-X1678
Insulator	RöKüV221Zub5K	Q81-X1686
Water level stabilizer with control electrodes	RöZubV4	Q81-X2105
LL electrolytic target	RöEl21	C65055-A667-A21
Gasket ring for boiler	RöN9373	C65051-A182-C506

1) Measured by means of a 30 cm × 30 cm screening plate in the grid terminal plane.

RF amplifier,
class B operation, grounded cathode circuit

Maximum ratings

Frequency	f	10	30	MHz
Anode voltage (dc)	U_A	16	12,5	kV
Grid voltage (dc)	U_G	– 1000	– 1000	V
Cathode current (dc)	I_K	18	18	A
Peak cathode current	I_{KM}	65	65	A
Anode dissipation	P_A	60	60	kW
Grid dissipation	P_G	1300	1300	W

Operating characteristics

Frequency	f	≤ 10	≤ 10	≤ 30	≤ 30	MHz
Output power	P_2	110	85	110	85	kW [1])
Anode voltage (dc)	U_A	15	15	12	12	kV
Grid voltage (dc)	U_G	– 260	– 260	– 210	– 210	V
Peak grid voltage (ac)	U_{gm}	600	520	650	520	V
Anode current (dc)	I_A	10,1	7,75	12,7	9,85	A
Grid current (dc)	I_G	2,0	1,3	3,0	1,9	A
Anode input power	P_{BA}	151	116,3	153	118	kW
Drive power	P_1	1080	610	1770	880	W [1])
Anode dissipation	P_A	41	31,3	43	33	kW
Grid dissipation	P_G	560	270	1140	480	W
Efficiency	η	73	73	72	72	%
Anode load resistance	R_A	920	1235	590	775	Ω

1) Circuit losses are not included.

RF amplifier, class B operation, grounded grid circuit

Maximum ratings

Frequency	f	10	30	60	MHz
Anode voltage (dc)	U_A	16	12,5	8,5	kV
Grid voltage (dc)	U_G	– 1000	– 1000	– 1000	V
Cathode current (dc)	I_K	18	18	18	A
Peak cathode current	$I_{K\,M}$	65	65	65	A
Anode dissipation	P_A	60	60	60	kW
Grid dissipation	P_G	1300	1300	1100	W

Operating characteristics

Frequency	f	≤ 10	≤ 30	≤ 60	MHz
Output power	P_2	85 + 3,1 [2])	85 + 3,9 [2])	57 + 3,5 [2])	kW [1])
Anode voltage (dc)	U_A	15	12	8,0	kV
Grid voltage (dc)	U_G	– 260	– 210	– 130	V
Peak grid voltage (ac)	$U_{g\,m}$	520	520	460 [3])	V
Anode current (dc)	I_A	7,75	9,85	10	A
Grid current (dc)	I_G	1,3	1,8	2,3	A
Anode input power	$P_{B\,A}$	116,3	118	80	kW
Drive power	P_1	0,61+3,1 [2])	0,88+3,9 [2])	0,93+3,5 [2])	kW [1])
Anode dissipation	P_A	31,3	33	23	kW
Grid dissipation	P_G	270	480	630	W
Efficiency	η	73	72	71	%
Anode load resistance	R_A	1280	815	490	Ω

1) Circuit losses are not included.
2) Power transition of grounded grid circuit.
3) For f = 60 MHz, the maximum permissible value of grid voltage $U_{g\,m\,max}$ = 500 V, when simultaneously keeping all other maximum ratings.

RF amplifier,
class C operation, grounded cathode circuit

Maximum ratings

Frequency	f	10	30	MHz
Anode voltage (dc)	U_A	16	12,5	kV
Grid voltage (dc)	U_G	– 1000	– 1000	V
Cathode current (dc)	I_K	18	18	A
Peak cathode current	$I_{K\,M}$	65	65	A
Anode dissipation	P_A	60	60	kW
Grid dissipation	P_G	1300	1300	W

Operating characteristics

Frequency	f	≤ 10	≤ 30	≤ 30	≤ 30	MHz
Output power	P_2	120	90	72	55	kW 1)
Anode voltage (dc)	U_A	15	12	10	8,0	kV
Grid voltage (dc)	U_G	– 600	– 550	– 500	– 450	V
Peak grid voltage (ac)	$U_{g\,m}$	1000	940	875	810	V
Anode current (dc)	I_A	9,75	9,25	9,0	8,75	A
Grid current (dc)	I_G	2,2	2,2	2,1	1,85	A
Anode input power	$P_{B\,A}$	146	111	90	70	kW
Drive power	P_1	2,1	1,9	1,7	1,55	kW 1)
Anode dissipation	P_A	26	21	18	15	kW
Grid dissipation	P_G	780	690	650	605	W
Efficiency	η	82	81	80	78,5	%
Anode load resistance	R_A	850	710	600	485	Ω

1) Circuit losses are not included.

RF amplifier,
class C operation, grounded grid circuit

Maximum ratings

Frequency	f	10	30	MHz
Anode voltage (dc)	U_A	16	12,5	kV
Grid voltage (dc)	U_G	– 1000	– 1000	V
Cathode current (dc)	I_K	18	18	A
Peak cathode current	I_{KM}	65	65	A
Anode dissipation	P_A	60	60	kW
Grid dissipation	P_G	1300	1300	W

Operating characteristics

Frequency	f	≤ 10	≤ 30	≤ 30	≤ 30	MHz
Output power	P_2	120+8,5 2)	90+7,7 2)	72+6,9 2)	55+6,1 2)	kW 1)
Anode voltage (dc)	U_A	15	12	10	8,0	kV
Grid voltage (dc)	U_G	– 600	– 550	– 500	– 450	V
Peak grid voltage (ac)	U_{gm}	1000	940	875	810	V
Anode current (dc)	I_A	9,75	9,25	9,0	8,75	A
Grid current (dc)	I_G	2,2	2,2	2,1	1,85	A
Anode input power	P_{BA}	146	111	90	70	kW
Drive power	P_1	2,1+8,5 2)	1,9+7,7 2)	1,7+6,9 2)	1,55+6,1 2)	kW 1)
Anode dissipation	P_A	26	21	18	15	kW
Grid dissipation	P_G	780	690	650	605	W
Efficiency	η	82	81	80	78,5	%
Anode load resistance	R_A	910	770	656	540	Ω

1) Circuit losses are not included.
2) Power transition of grounded grid circuit.

Anode voltage modulation, grounded cathode circuit

Maximum ratings

Frequency	f	30	MHz
Anode voltage (dc)	U_A	11,5	kV
Grid voltage (dc)	U_G	– 1000	V
Cathode current (dc)	I_K	12	A
Peak cathode current	$I_{K\,M}$	75	A
Anode dissipation	P_A	60	kW
Grid dissipation	P_G	1300	W

Operating characteristics

Frequency	f	≤ 30	≤ 30	MHz
Carrier power	P_{trg}	66	55	kW [1])
Anode voltage (dc)	U_A	11	10	kV
Grid bias (dc), fixed	$U_{G\,fix}$	– 200	– 190	V
Grid resistance	R_G	90	80	Ω
Peak grid voltage (ac)	$U_{g\,m}$	880	810	V
Anode current (dc)	I_A	7,6	6,9	A
Grid current (dc)	I_G	3,1	3,1	A
Anode input power	$P_{B\,A}$	83,6	69	kW
Drive power	P_1	2,7	2,4	kW [1])
Anode dissipation	P_A	17,6	14	kW [2])
Grid dissipation	P_G	1140	1000	W
Efficiency	η	79	79	%
Anode load resistance	R_A	920	930	Ω
Modulation factor	m	100	100	%
Modulation power	P_{mod}	41,8	34,5	kW
Grid current (dc)	I_G	3,95	3,8	A [3])
Drive power	P_1	3,25	2,9	kW [1]) [3])
Grid current (dc)	I_G	2,6	2,4	A [4])
Drive power	P_1	2,1	1,8	kW [1]) [4])

1) Circuit losses are not included.
2) Even during modulation the indicated maximum ratings must not be exceeded. It has to be observed that during 100 % modulation the anode dissipation increases to about 1,5 times the power dissipation stated for the carrier value.
3) Maximum values at $U_A = 0$ V.
4) Maximum values at peak modulation.

VX

Anode voltage modulation, grounded grid circuit

Maximum ratings

Frequency	f	30	MHz
Anode voltage (dc)	U_A	11,5	kV
Grid voltage (dc)	U_G	– 1000	V
Cathode current (dc)	I_K	12	A
Peak cathode current	I_{KM}	75	A
Anode dissipation	P_A	60	kW
Grid dissipation	P_G	1300	W

Operating characteristics

Frequency	f	≤ 30	≤ 30	MHz
Carrier power	P_{trg}	66 + 5,3 [2]	55 + 4,4 [2]	kW [1]
Anode voltage (dc)	U_A	11	10	kV
Grid bias (dc), fixed	$U_{G\,fix}$	– 200	– 190	V
Grid resistance	R_G	90	80	Ω
Peak grid voltage (ac)	$U_{g\,m}$	880	810	V
Anode current (dc)	I_A	7,6	6,9	A
Grid current (dc)	I_G	3,1	3,1	A
Anode input power	P_{BA}	83,6	69	kW
Drive power	P_1	2,7 + 5,3 [2]	2,4 + 4,4 [2]	kW [1]
Anode dissipation	P_A	17,6	14	kW [3]
Grid dissipation	P_G	1140	1000	W
Efficiency	η	79	79	%
Anode load resistance	R_A	990	985	Ω
Modulation factor	m	100	100	%
Peak modulation voltage	$U_{mod\,m}$	11	10	kV
Modulation power	P_{mod}	43	35	kW
Grid current (dc)	I_G	3,95	3,8	A [4]
Drive power	P_1	3,25 + 0 [2]	2,9 + 0 [2]	kW [1] [4]
Grid current (dc)	I_G	2,6	2,4	A [5]
Drive power	P_1	2,1+11,25 [2]	1,8 + 9,4 [2]	kW [1] [5]
Anode dissipation during modulation	$P_{A\,mod}$	27	21	kW

1) Circuit losses are not included.
2) Power transition of grounded grid circuit.
3) Even during modulation the indicated maximum ratings must not be exceeded. It has to be observed that during 100 % modulation the anode dissipation increases to about 1,5 times the power dissipation stated for the carrier value.
4) Maximum values at $U_A = 0$ V.
5) Maximum values at peak modulation.

AF amplifier and modulator, class B operation, 2 tubes in push-pull circuit

Maximum ratings

Anode voltage (dc)	U_A	12	kV
Grid voltage (dc)	U_G	– 1000	V
Cathode current (dc)	I_K	18	A
Peak cathode current	$I_{K\,M}$	65	A
Anode dissipation	P_A	60	kW
Grid dissipation	P_G	1300	W

Operating characteristics

at modulator operation for

		100 kW carrier power				
Output power	P_2	0	78	0	78	kW
Anode voltage (dc)	U_A	11	11	10	10	kV
Grid voltage (dc)	U_G	– 190	– 190	– 170	– 170	V
Peak control grid voltage (ac) between the 2 tubes	$U_{gg\,m}$	0	710	0	710	V
Anode current (dc)	I_A	2 × 0,4	2 × 5,3	2 × 0,4	2 × 5,75	A
Grid current (dc)	I_G	0	2 × 0,6	0	2 × 0,72	A
Peak grid current	$I_{G\,M}$	0	2 × 3,6	0	2 × 4	A
Anode input power	$P_{B\,A}$	2 × 4	2 × 58	2 × 4	2 × 57,5	kW
Drive power	P_1	0	2 × 190	0	2 × 235	W
Anode dissipation	P_A	2 × 4	2 × 19	2 × 4	2 × 18,5	kW
Grid dissipation	P_G	0	2 × 75	0	2 × 115	W
Efficiency	η	–	67,5	–	68	%
Effective load resistance (anode to anode)	R_{AA}	–	2260	–	1810	Ω

Tube mounting

Axis vertical, anode down.

For connection of the cathode use the terminals listed under "Accessories".

For the connection of the grid a number of tapholes M5 is provided at the grid terminal ring; the delivery includes knurled head screws for this purpose.

The use of the concentric grid terminal as listed under "Accessories" is recommended if a very low grid line inductance is required. This concentric grid terminal is equipped with a large number of contact springs which closely join the surface of the grid contact ring.

Maximum tube surface temperature

The temperature of the glass and metal parts and of the cathode terminals must not exceed 220 °C at any point.

Vapor cooling

Cooling data for maximum anode dissipation	$P_{A\,max}$ = 60 kW
Total power to be dissipated by the cooling system ($P_A + P_G + 0{,}8\ P_F$)	63 kW
Equivalent thermal output	3780 kJ/min (900 kcal/min)
Flow rate of returning water	
at returning water temperature of 20 °C	approx. 1,5 l/min
at returning water temperature of 90 °C	approx. 1,7 l/min
Volume of generated vapor	
at returning water temperature of 20 °C	approx. 2,5 m^3/min
at returning water temperature of 90 °C	approx. 2,8 m^3/min

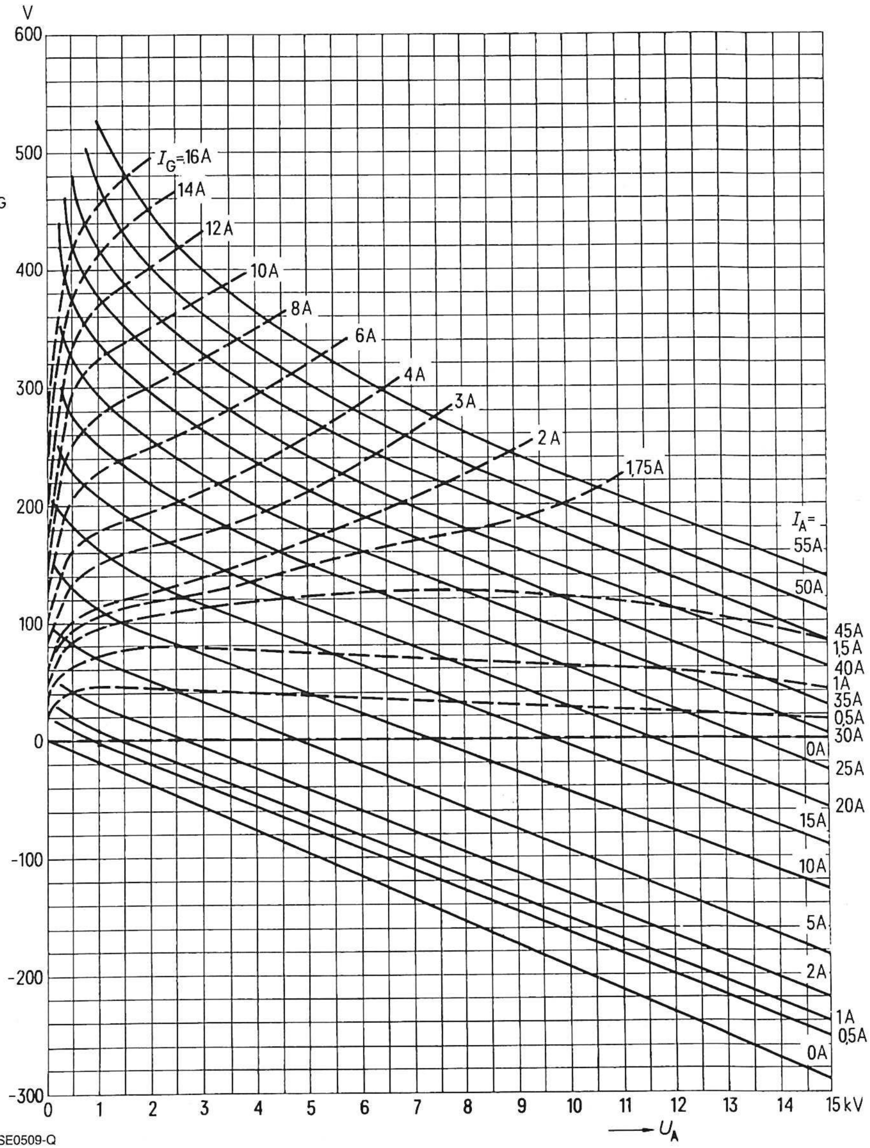
Detailed information on vapor cooling upon request. Please observe instructions on vapor cooling given under "Explanations on Technical Data".

Safety precautions

The section "Safety precautions" under "Explanations on Technical Data" describes how the tube is to be protected against damage due to electric overload or insufficient cooling. A copper wire with 0,26 mm diameter should be used to test the anode overcurrent trip circuit.

For protection against thermal anode overload the tube fuse RöSich4 is recommended. In conjunction with pull switch RöKt11 it disconnects the voltages at the tube in case of overload (see accessories).

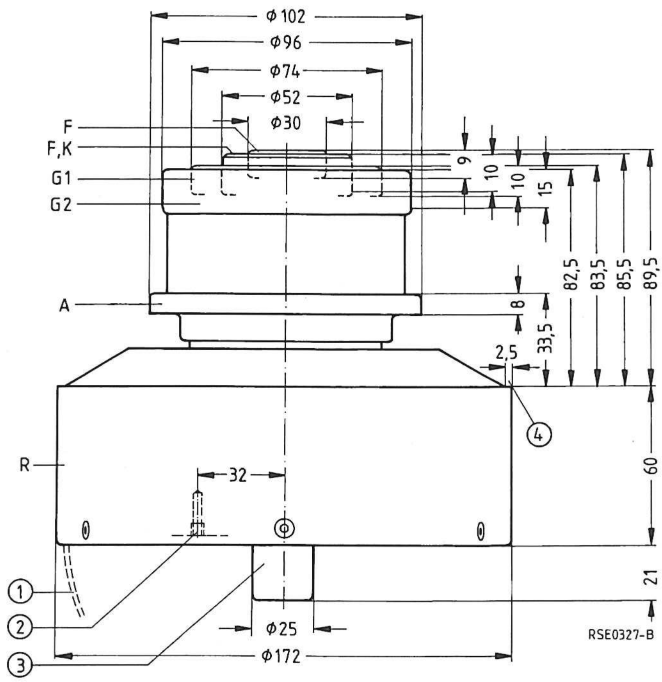
$U_G = f(U_A)$ Parameter = I_A ———————
Parameter = I_G — — — — — — —



RSE0509-Q

For frequencies up to 300 MHz Ordering code Q51-X2022

Coaxial metal-ceramic tetrode for frequencies up to 300 MHz, forced-air-cooled; particularly suitable for TV transmitters in grounded control-grid screen-grid circuit.



Dimensions in mm

① Handle, swingable
② Taphole for tube fuse RöSich7
③ Do not use as terminal
④ Free for anode support

Approx. weight 6,7 kg

The radiator and the terminals are of concentric design with the following diameters:

Radiator	Ø 173,5	Control grid terminal	Ø 75,0
Anode terminal	Ø 103,0	Heater/cathode terminal	Ø 52,6
Screen grid terminal	Ø 97,0	Heater terminal	Ø 30,6

Heating

Heater voltage	U_F	10	V
Heater current	I_F	≈ 86	A
Heating: direct			
Cathode: thoriated tungsten			

Characteristics

Emission current at $U_A = U_{G2} = U_{G1} = 300$ V	I_{em}	35	A
Amplification factor of screen grid at $U_A = 2$ kV, $U_{G2} = 600$ to 1000 V, $I_A = 3$ A	μ_{g2g1}	8,4	
Transconductance at $U_A = 2$ kV, $U_{G2} = 800$ V, $I_A = 2{,}5$ to $3{,}5$ A	s	70	mA/V

Capacitances

Cathode/control grid	c_{kg1}	≈ 76	pF
Cathode/screen grid	c_{kg2}	≈ 5,5	pF
Cathode/anode	c_{ka}	≈ 0,07	pF 1)
Control grid/screen grid	c_{g1g2}	≈ 126	pF
Control grid/anode	c_{g1a}	≈ 0,75	pF 1)
Screen grid/anode	c_{g2a}	≈ 21	pF

Accessories			Ordering code
Socket wrench for tube fuse		RöZub09	Q81-X2109
Tube fuse		RöSich7	Q81-X1407
Pull switch for tube fuse		RöKt11	Q81-X1311
Cavity band III,	10 kW vision	TK4801	Q94-X4801
	5 kW vision/sound	TK4801	Q94-X4801
Spring-finger contacts:			
Internal cathode terminal			C65055-A815-C901
External cathode terminal			C65055-A815-C902
Control grid terminal			C65055-A815-C903
Screen grid terminal			C65055-A815-C904

1) Measured by means of a 30 cm diameter screening plate in the screen-grid terminal plane.

TV vision transmitter, grounded control-grid screen-grid circuit, negative modulation

Maximum ratings

Frequency	f	250	MHz
Anode voltage (dc)	U_A	5,5	kV 1)
Screen grid voltage (dc)	U_{G2}	1000	V 1)
Control grid voltage (dc)	U_{G1}	– 250	V
Cathode current (dc)	I_K	8,0	A
Peak cathode current	$I_{K\,M}$	35	A
Anode dissipation	P_A	12	kW
Screen grid dissipation	P_{G2}	150	W
Control grid dissipation	P_{G1}	50	W

Operating characteristics

Frequency	f	220	220	220	MHz
Bandwidth (– 3 dB)	B	12	18	12	MHz 2)
Bandwidth (– 1,2 dB)	B	7,0	10	7,0	MHz 2)
Output power, sync. level	$P_{2\,SY}$	16+0,63 3) 8)	12+0,53 3)	12+0,42 3)	kW 4)
Output power, black level	$P_{2\,SW}$	9+0,36 3)	6,6+0,29 3)	6,6+0,22 3)	kW 4) 5)
Anode voltage (dc)	U_A	5,2	4,0	4,8	kV 1)
Screen grid voltage (dc)	U_{G2}	900	800	800	V 1)
Control grid voltage (dc)	U_{G1}	– 85	– 75	– 75	V 6)
Peak control grid voltage (ac), sync. level	$U_{g1\,m\,SY}$	170	140	130	V
Anode current (dc), black level	$I_{A\,SW}$	3,8	3,7	3,1	A 5)
Screen grid current (dc), black level	$I_{G2\,SW}$	120	110	100	mA 5)
Control grid current (dc), black level	$I_{G1\,SW}$	50	60	30	mA 5)
Anode input power, black level	$P_{B\,A\,SW}$	19,8	14,9	14,9	kW 5)
Drive power, sync. level	$P_{1\,SY}$	46+630 3)	30+530 3)	10+420 3)	W 7)
Anode dissipation, black level	$P_{A\,SW}$	10,8	8,3	8,3	kW 5)
Screen grid dissipation, black level	$P_{G2\,SW}$	110	88	80	W 5)
Control grid dissipation, black level	$P_{G1\,SW}$	2,0	25	2,0	W 5)
Anode load resistance	R_A	570	400	600	Ω

1) Voltage measurement against cathode.
2) Bandwidth calculated from tube capacitance c_{g2a}.
3) Power transition of grounded grid circuit.
4) Circuit losses are not included.
5) Black level with gated sync. pulses.
6) For zero signal dc anode current $I_{A\,0}$ = 1,6 A.
7) Output power required from driver stage.
8) 5 % compression of the sync. pulse can be expected. Linearity of color subcarrier ≥ 0,9.

Combined vision and sound amplifier for TV translators, grounded control-grid screen-grid circuit, vision-to-sound ratio 10:1

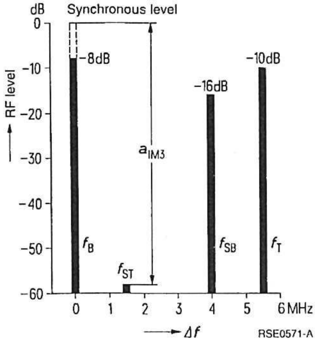
Maximum ratings

Frequency	f	250	MHz
Anode voltage (dc)	U_A	5,5	kV
Screen grid voltage (dc)	U_{G2}	1000	V
Control grid voltage (dc)	U_{G1}	– 250	V
Cathode current (dc)	I_K	8,0	A
Peak cathode current	$I_{K\,M}$	35	A
Anode dissipation	P_A	12	kW
Screen grid dissipation	P_{G2}	150	W
Control grid dissipation	P_{G1}	50	W

Operating characteristics

Frequency	f	220	220	MHz
Bandwidth	B	10	10	MHz
Output power, sync. level	$P_{2\,SY}$	5,5/0,55	2,2/0,22	kW [1]
3-tone intermodulation ratio	a_{IM3}	≥ 58	≥ 60	dB [2]
Anode voltage (dc)	U_A	4,7	3,6	kV
Screen grid voltage (dc)	U_{G2}	850	850	V
Control grid voltage (dc)	U_{G1}	– 70	– 70	V [3]
Anode current (dc), black level	$I_{A\,SW}$	2,8	2,25	A
Screen grid current (dc), black level	$I_{G2\,SW}$	80	0	mA
Control grid current (dc), black level	$I_{G1\,SW}$	20	0	mA
Anode input power, black level	$P_{B\,A\,SW}$	13,2	8,1	kW
Drive power, sync. level	$P_{1\,SY}$	150	90	W
Drive power, sound	$P_{1\,Ton}$	15	9,0	W
Anode dissipation, black level	$P_{A\,SW}$	9,6	6,7	kW
Anode load resistance	R_A	600	500	Ω

Level diagram



1) Power at transmitter output with 90 % circuit efficiency.
2) Level of the largest in-band intermodulation product below the peak sync. level, as measured in accordance with specification FTZ 176 Pfl 2 of the German Telekom , with a distortionless input signal;
f_B: – 8 dB,
f_{SB}: – 16 dB,
f_T: – 10 dB.
3) For zero signal dc anode current $I_{A\,0}$ = 2,2 A.

VX

Tube mounting

Axis vertical, anode up or down.

The cavity TK 4801 is available for tube operation in TV band III (see accessories).

Maximum tube surface temperature

The temperature of the metal-ceramic seals must not exceed 220 °C at any point and the temperature of the internal cathode terminal must not exceed 250 °C. These requirements can be met without additional cooling of the terminals if an appropriate air duct and sufficient space between the individual contact springs is provided so that enough cooling air can pass through.

Forced-air cooling

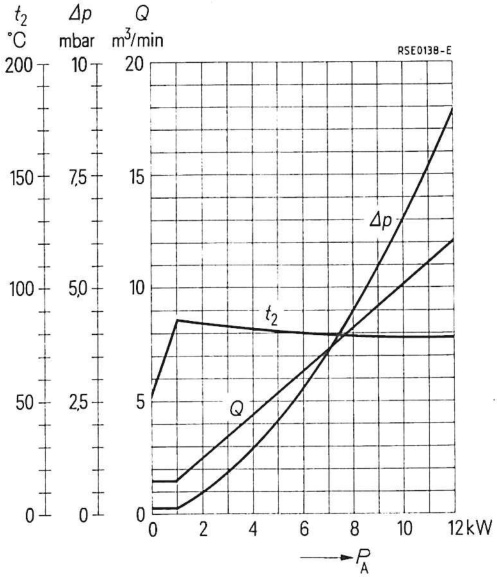
The minimum air flow rate required for maximum anode dissipation is given in the cooling air diagram valid for 25 °C inlet temperature at a normal air pressure of 1 bar (sea level). The cooling air must be supplied from the side of the electrode terminals. For further information on forced-air cooling refer to "Explanations on Technical Data".

Safety precautions

The section "Safety precautions" under "Explanations on Technical Data" describes how the tube is to be protected against damage due to electric overload or insufficient cooling. A copper wire with 0,20 mm diameter should be used to test the anode overcurrent trip circuit.

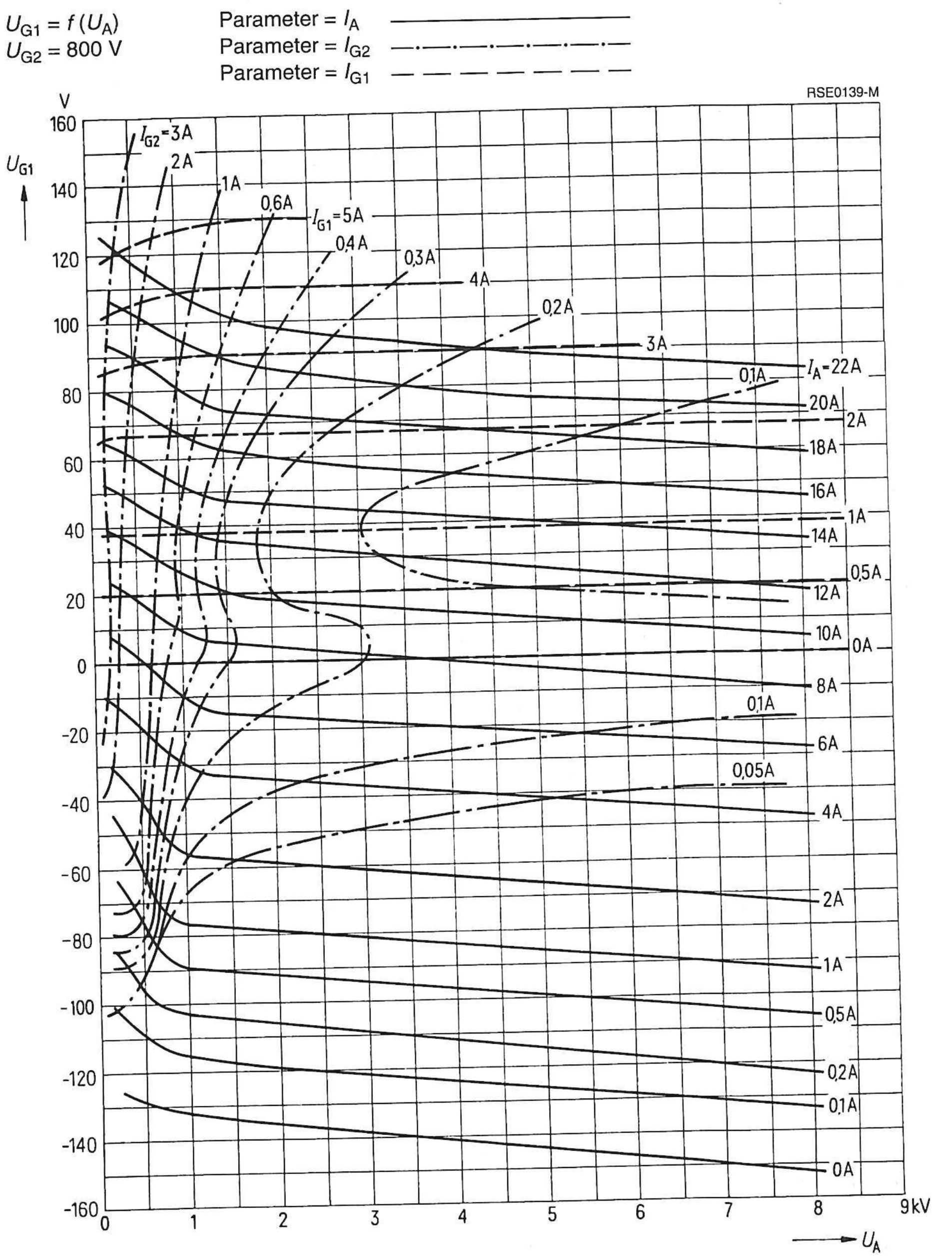
For protection against thermal anode overload the tube fuse RöSich7 is recommended. In conjunction with pull switch RöKt11 it disconnects the voltages at the tube in case of overload (see accessories).

Cooling air diagram



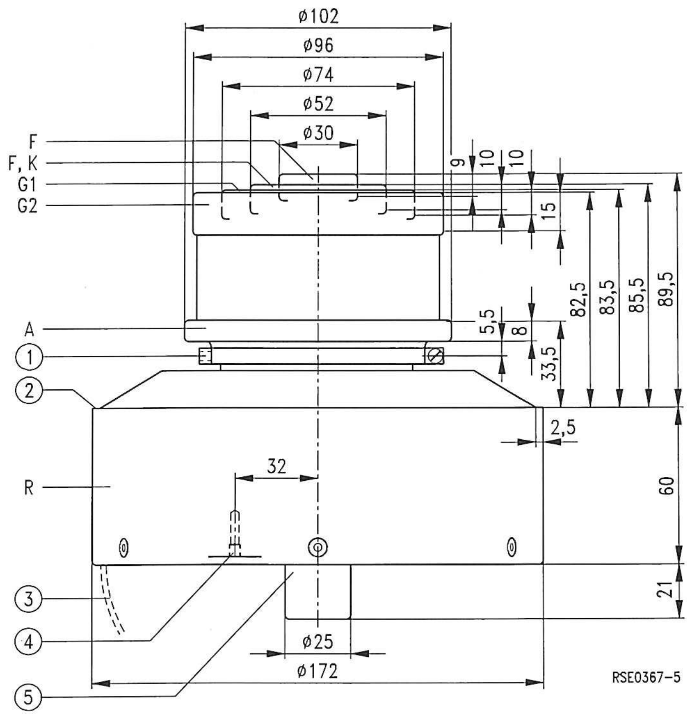
The cooling air is supplied from the electrode terminal side.

Air pressure = 1 bar
t_1 = 25 °C


$U_{G1} = f(U_A)$
$U_{G2} = 800$ V
Parameter = I_A
Parameter = I_{G2}
Parameter = I_{G1}
RSE0139-M
V
U_{G1}
160
140
120
100
80
60
40
20
0
-20
-40
-60
-80
-100
-120
-140
-160
0
1
2
3
4
5
6
7
8
9 kV
U_A
I_{G2} = 3A
2A
1A
0,6A
I_{G1} = 5A
0,4A
0,3A
4A
0,2A
3A
0,1A
I_A = 22A
20A
2A
18A
16A
1A
14A
0,5A
12A
10A
0A
8A
0,1A
6A
0,05A
4A
2A
1A
0,5A
0,2A
0,1A
0A

Ordering code Q51-X2024

Coaxial metal-ceramic tetrode, forced-air-cooled, for frequencies up to 300 MHz. Due to the low feedback capacitance c_{g1a} the tube is also suitable for use in grounded cathode circuit.



Dimensions in mm

① Taphole M4 for tube fuse RöSich10
② Free for anode support
③ Handle, swingable
④ Taphole for tube fuse RöSich7
⑤ Do not use as terminal

Approx. weight 6,7 kg

The radiator and the terminals are of concentric design with the following diameters:

Radiator	Ø 173,5	Control grid terminal	Ø 75,0
Anode terminal	Ø 103,0	Heater/cathode terminal	Ø 52,6
Screen grid terminal	Ø 97,0	Heater terminal	Ø 30,6

VX

Heating

Heater voltage	U_F	9,5	V
Heater current	I_F	≈ 80	A
Heating: direct			
Cathode: thoriated tungsten			

Kennwerte

Emission current at $U_A = U_{G2} = U_{G1} = 300$ V	I_{em}	35	A
Amplification factor of screen grid at $U_A = 2$ kV, $U_{G2} = 600$ to 1000V, $I_A = 2$ A	μ_{g2g1}	8,0	
Transconductance at $U_A = 2$ kV, $U_{G2} = 800$ V, $I_A = 1{,}5$ to 2,5 A	s	53	mA/V

Capacitances

Cathode/control grid	c_{kg1}	≈ 78	pF
Cathode/screen grid	c_{kg2}	≈ 5,5	pF
Cathode/anode	c_{ka}	≈ 0,04	pF [1])
Control grid/screen grid	c_{g1g2}	≈ 115	pF
Control grid/anode	c_{g1a}	≈ 0,32	pF [1])
Screen grid/anode	c_{g2a}	≈ 22	pF

Accessories

		Ordering code
Socket wrench for tube fuse	RöZub09	Q81-X2109
Socket wrench for tube fuse	RöZub10	Q81-X2110
Tube fuse	RöSich7	Q81-X1407
Tube fuse	RöSich10	Q81-X1410
Pull switch for tube fuse	RöKt11	Q81-X1311
Spring-finger contacts:		
Internal cathode terminal		C65055-A815-C901
External cathode terminal		C65055-A815-C902
Control grid terminal		C65055-A815-C903
Screen grid terminal		C65055-A815-C904

1) Measured by means of a 50 cm diameter screening plate in the screen-grid terminal plane.

RF amplifier, class B operation, grounded cathode circuit

Maximum ratings

Frequency	f	110	MHz
Anode voltage (dc)	U_A	9	kV
Screen grid voltage (dc)	U_{G2}	1000	V
Control grid voltage (dc)	U_{G1}	– 250	V
Cathode current (dc)	I_K	6	A
Peak cathode current	$I_{K\,M}$	35	A
Anode dissipation	P_A	12	kW
Screen grid dissipation	P_{G2}	270	W
Control grid dissipation	P_{G1}	70	W

Operating characteristics

Frequency	f	≤ 110	MHz
Output power	P_2	12	kW [1])
Anode voltage (dc)	U_A	7,5	kV
Screen grid voltage (dc)	U_{G2}	800	V
Control grid voltage (dc)	U_{G1}	– 100	V [2])
Peak control grid voltage (ac)	$U_{g1\,m}$	110	V
Anode current (dc)	I_A	2,3	A
Screen grid current (dc)	I_{G2}	200	mA
Control grid current (dc)	I_{G1}	50	mA
Anode input power	$P_{B\,A}$	17,2	kW
Drive power	P_1	5,0	W [3])
Anode dissipation	P_A	5,2	kW
Screen grid dissipation	P_{G2}	160	W
Efficiency	η	70	%
Anode load resistance	R_A	1800	Ω

1) Circuit losses are not included.
2) For zero signal dc anode current $I_{A\,0}$ = 0,4 A.
3) Additional loss in the grid circuit is not taken into consideration.

VX

Tube mounting

Axis vertical, anode up or down.

Spring-finger contacts can be ordered for cavity design (accessories).

Maximum tube surface temperature

The temperature of the tube's metal-ceramic seals must not exceed 220 °C at any point and the temperature of the internal cathode terminal must not exceed 250 °C. These requirements can be met without additional cooling of the terminals if an appropriate air duct and sufficient space between the individual contact springs is provided so that enough cooling air can pass through.

Forced-air cooling

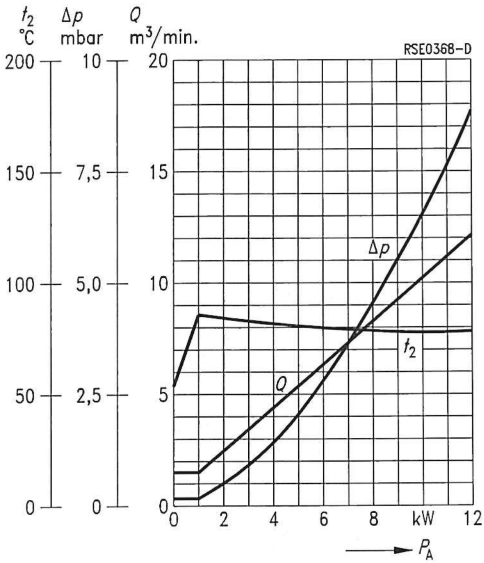
The minimum air flow rate required for maximum anode dissipation is given in the cooling air diagram valid for 25 °C inlet temperature at a normal air pressure of 1 bar (sea level). The cooling air must be supplied from the side of the electrode terminals. For further information on forced-air cooling refer to "Explanations on Technical Data".

Safety precautions

The section "Safety precautions" under "Explanations on Technical Data" describes how the tube is to be protected against damage due to electric overload or insufficient cooling. A copper wire with 0,20 mm diameter should be used to test the anode overcurrent trip circuit.

For protection against thermal anode overload the tube fuse RöSich7/RöSich10 is recommended. In conjunction with pull switch RöKt11 it disconnects the voltages at the tube in case of overload (accessories).

Cooling air diagram



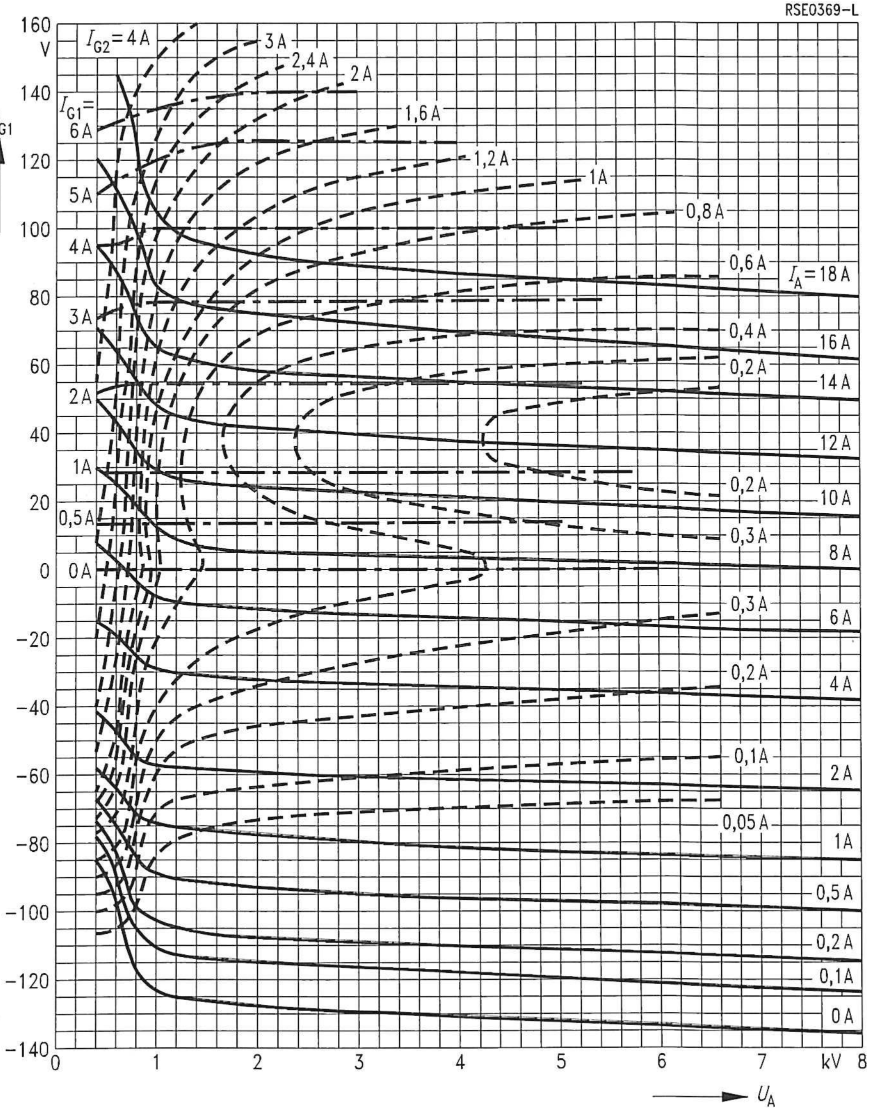
The cooling air is supplied from the electrode terminal side.

Air pressure = 1 bar

t_1 = 25°C

$U_{G1} = f(U_A)$
$U_{G2} = 800$ V

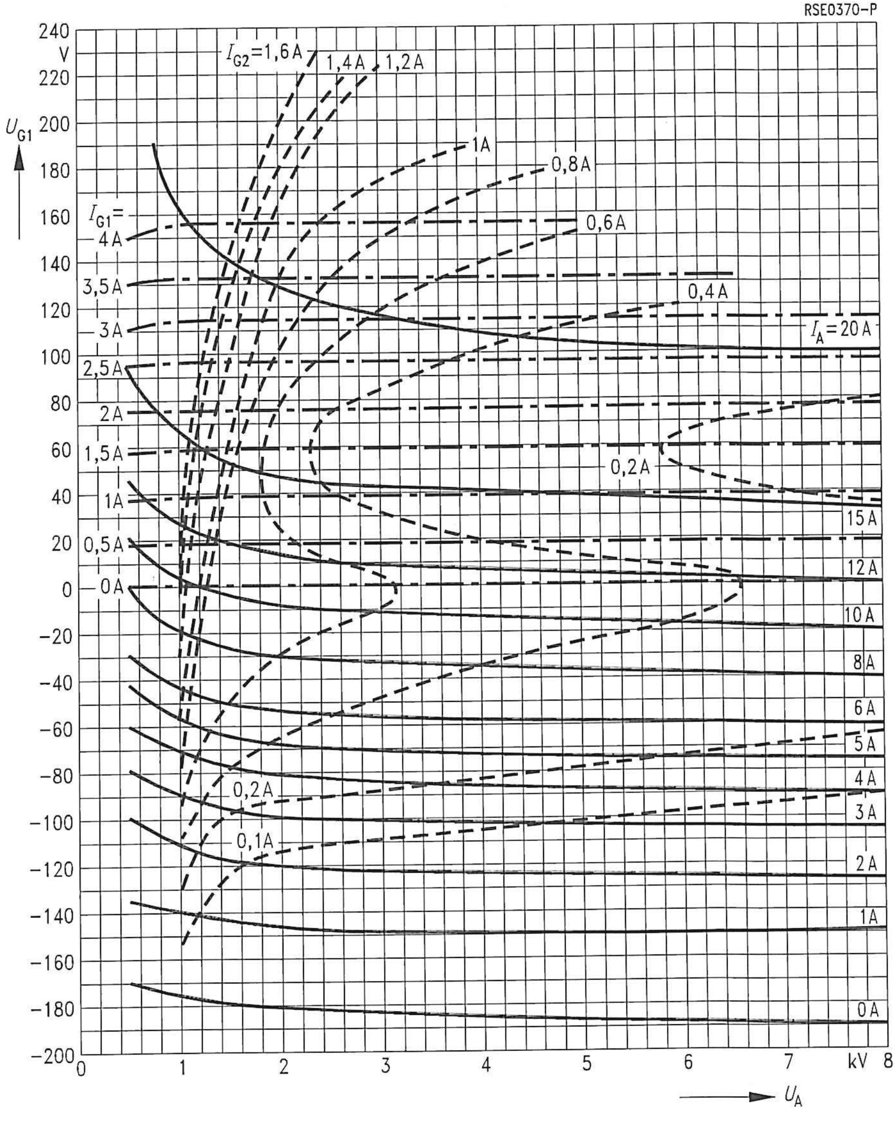
Parameter = I_A ————————
Parameter = I_{G2} — — — — — —
Parameter = I_{G1} —·—·—·—·—



$U_{G1} = f(U_A)$ Parameter = I_A ————————

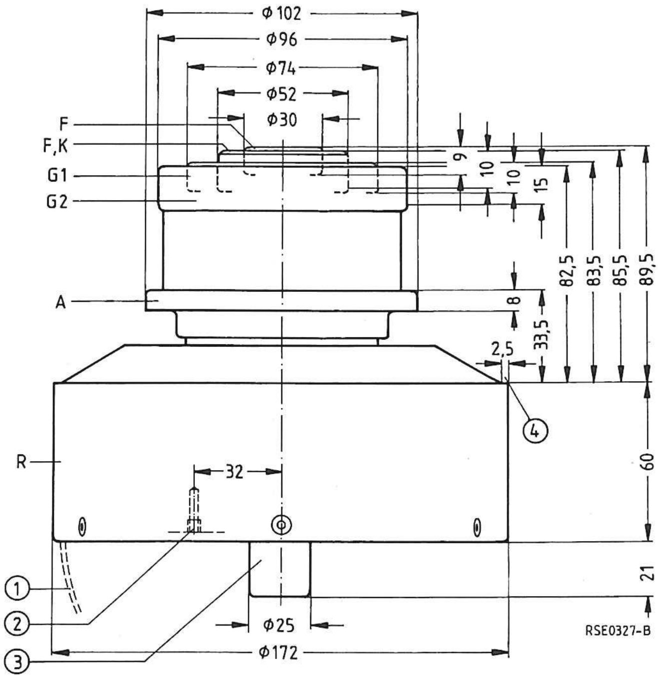
$U_{G2} = 1000$ V Parameter = I_{G2} — — — — — — —

Parameter = I_{G1} —·—·—·—·—·—



For transmitters, band III Ordering code Q51-X2026

Coaxial metal-ceramic-tetrode, forced-air-cooled, for frequencies up to 300 MHz, particulary suitable for TV transmitters in grounded control-grid circuit.



Dimensions in mm

① Handle, swingable
② Taphole for tube fuse RöSich7
③ Do not use as terminal
④ Free for anode support

Approx. weight 6,7 kg

The radiator and the terminals are of concentric design with the following diameters:

Radiator	Ø 173,5	Control grid terminal	Ø 75,0
Anode terminal	Ø 103,0	Heater/cathode terminal	Ø 52,6
Screen grid terminal	Ø 97,0	Heater terminal	Ø 30,6

Heating

Heater voltage	U_F	9,5	V
Heater current	I_F	≈ 86	A
Heating: direct			
Cathode: thoriated tungsten			

Characteristics

Emission current at $U_A = U_{G2} = U_{G1} = 300$ V	I_{em}	35	A
Amplification factor of screen grid at $U_A = 2$ kV, $U_{G2A} = 600$ to 1000V, $I_A = 3$ A	μ_{g2g1}	7,4	
Transconductance at $U_A = 2$ kV, $U_{G2} = 800$ V, $I_A = 2{,}5$ to 3,5 A	s	70	mA/V

Capacitances

Cathode/control grid	c_{kg1}	≈ 75	pF
Cathode/screen grid	c_{kg2}	≈ 5,9	pF
Cathode/anode	c_{ka}	≈ 0,08	pF [1]
Control grid/screen grid	c_{g1g2}	≈ 127	pF
Control grid/anode	c_{g1a}	≈ 0,77	pF [1]
Screen grid/anode	c_{g2a}	≈ 21	pF

Accessories		Ordering code
Socket wrench for tube fuse	RöZub09	Q81-X2109
Tube fuse	RöSich7	Q81-X1407
Pull switch for tube fuse	RöKt11	Q81-X1311
Cavity band III, 20 kW vision	TK4464	Q94-X4464
Spring-finger contacts:		
Internal cathode terminal		C65055-A815-C901
External cathode terminal		C65055-A815-C902
Control grid terminal		C65055-A815-C903
Screen grid terminal		C65055-A815-C904

1) Measured by means of a 30 cm diameter screening plate in the screen grid terminal plane.

TV vision transmitter, grounded control-grid screen-grid circuit, negative modulation

Maximum ratings

Frequency	f	250	MHz
Anode voltage (dc)	U_A	7,0	kV 1)
Screen grid voltage (dc)	U_{G2}	1000	V 1)
Control grid voltage (dc)	U_{G1}	– 250	V
Cathode current (dc)	I_K	8,0	A
Peak cathode current	$I_{K\,M}$	35	A
Anode dissipation	P_A	16	kW
Screen grid dissipation	P_{G2}	150	W
Control grid dissipation	P_{G1}	50	W

Operating characteristics

Frequency	f	220	MHz
Bandwidth (– 3 dB)	B	10	MHz 2)
Bandwidth (– 1,2 dB)	B	5,6	MHz 2)
Output power, sync. level	$P_{2\,SY}$	22 + 0,65 3)	kW 4)8)
Output power, black level	$P_{2\,SW}$	12,3 + 0,36 3)	kW 4)5)
Anode voltage (dc)	U_A	6,5	kV 1)
Screen grid voltage (dc)	U_{G2}	850	V 1)
Control grid voltage (dc)	U_{G1}	– 95	V 6)
Peak control grid voltage (ac), sync. level	$U_{g1\,m\,SY}$	160	V
Anode current (dc), black level	$I_{A\,SW}$	4,1	A 5)
Screen grid current (dc), black level	$I_{G2\,SW}$	130	mA 5)
Control grid current (dc), black level	$I_{G1\,SW}$	70	mA 5)
Anode input power, black level	$P_{B\,A\,SW}$	26,6	kW 5)
Drive power, sync. level	$P_{1\,SY}$	14 + 650 3)	W 7)
Anode dissipation, black level	$P_{A\,SW}$	14,3	kW 5)
Screen grid dissipation, black level	$P_{G2\,SW}$	100	W 5)
Control grid dissipation, black level	$P_{G1\,SW}$	5	W 5)
Anode load resistance	R_A	700	Ω

1) Voltage measurement based on cathode.
2) Bandwidth calculated from tube capacitance c_{g2a}.
3) Power transition of grounded grid circuit.
4) Circuit losses are not included.
5) Black level with gated sync. pulses.
6) For zero signal dc anode current $I_{A\,0}$ = 1,6 A.
7) Output power required from driver stage.
8) 5 % compression of the sync. pulse can be expected. Linearity of color subcarrier ≥ 0,9.

Tube mounting

Axis vertical, anode up or down.

The cavity TK 4464 is available for tube operation in TV band III (accessories).

Maximum tube surface temperature

The temperature of the metal-ceramic seals must not exceed 220 °C at any point and the temperature of the internal cathode terminal must not exceed 250 °C. These requirements can be met without additional cooling of the terminals if an appropriate air duct and sufficient space between the individual contact springs is provided so that enough cooling air can pass through.

Forced-air cooling

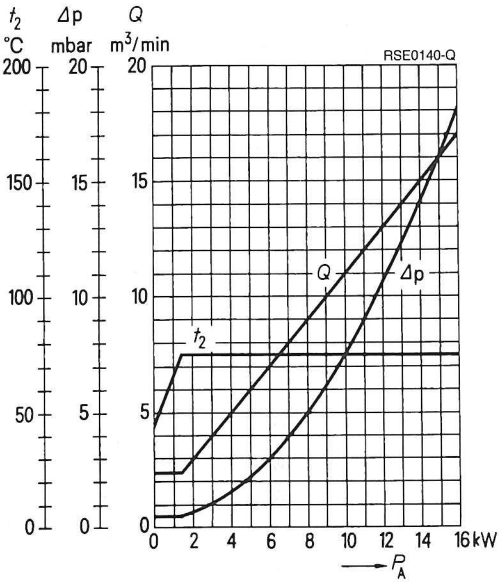
The minimum air flow rate required for maximum anode dissipation is given in the cooling air diagram valid for 25 ° inlet temperature at a normal air pressure of 1 bar (sea level). The cooling air must be supplied from the side of the electrode terminals. For further information on forced-air cooling refer to "Explanations on Technical Data".

Safety precautions

The section "Safety precautions" under "Explanations on Technical Data" describes how the tube is to be protected against damage due to electric overload or insufficient cooling. A copper wire with 0,20 mm diameter should be used to test the anode overcurrent trip circuit.

For protection against thermal anode overload the tube fuse RöSich7 is recommended. In conjunction with pull switch RöKt11 it disconnects the voltages at the tube in case of overload (accessories).

Cooling air diagram



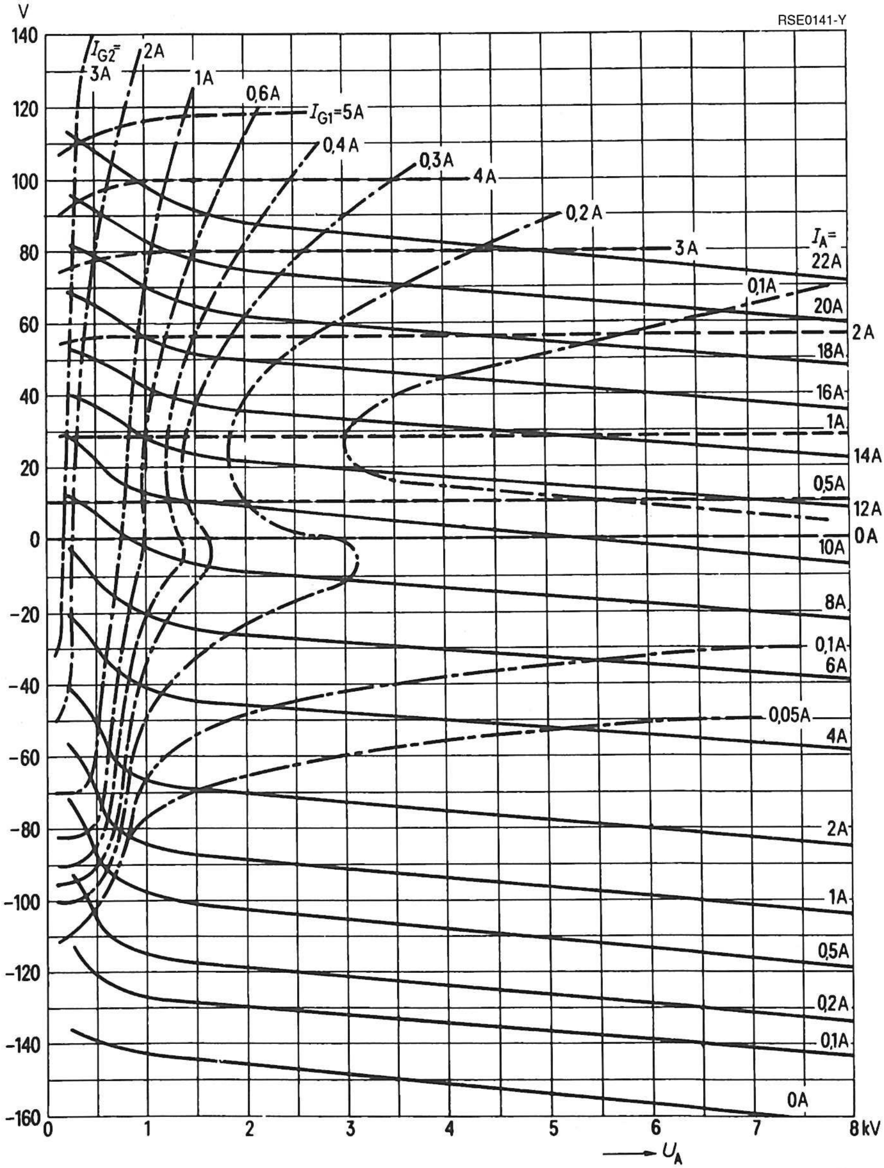
The cooling air is supplied from the electrode terminal side.

Air pressure = 1 bar

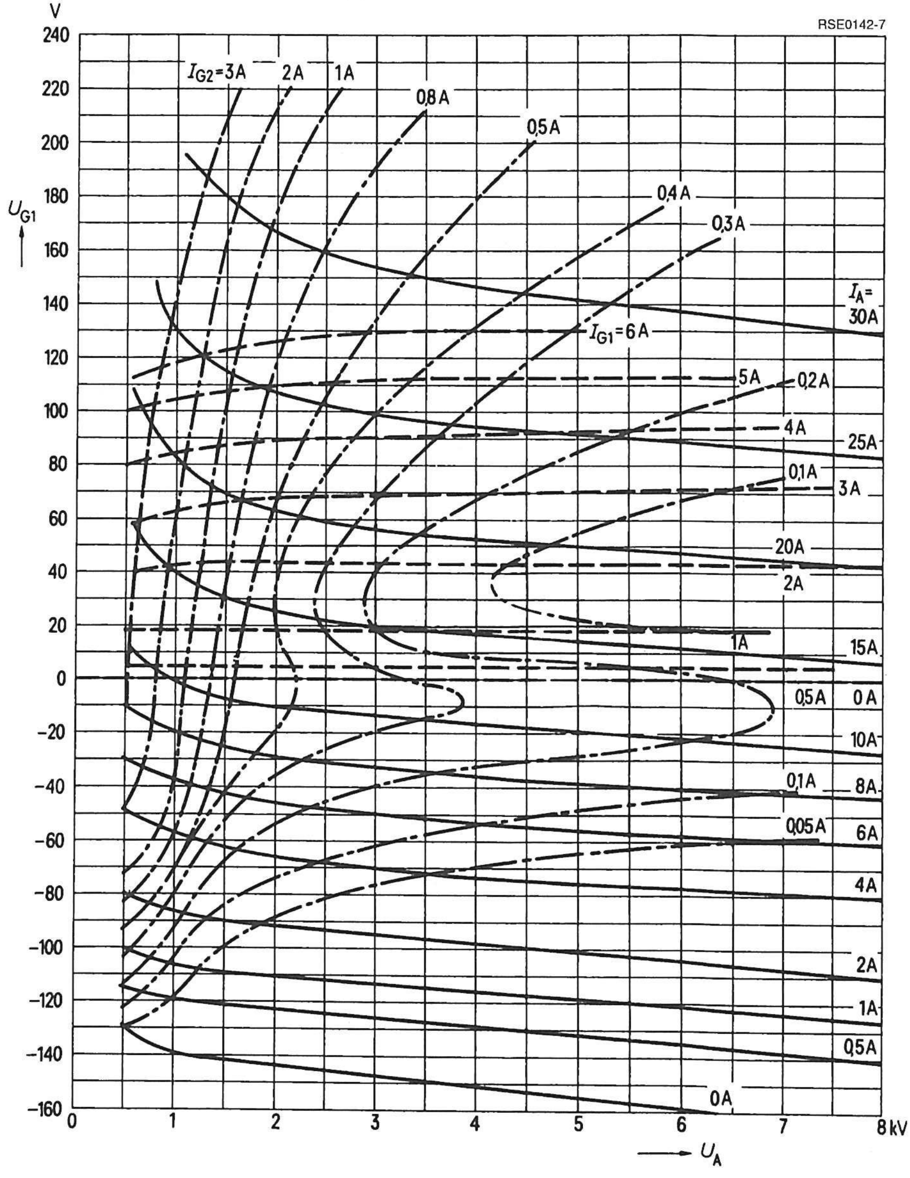
t_1 = 25°C

$U_{G1} = f(U_A)$
$U_{G2} = 800$ V

Parameter = I_A ————————
Parameter = I_{G2} —·—·—·—·—
Parameter = I_{G1} — — — — — —



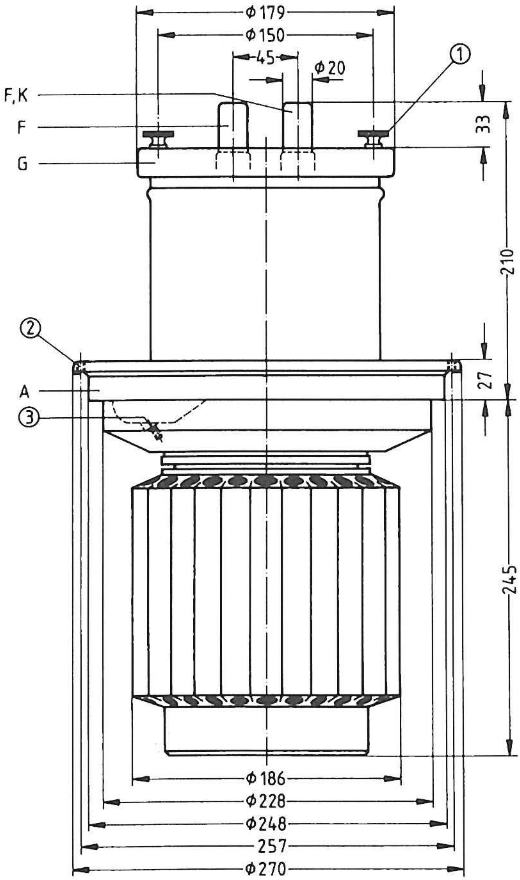
$U_{G1} = f(U_A)$ Parameter = I_A ————————
$U_{G2} = 1000$ V Parameter = I_{G2} —·—·—·—·—
Parameter = I_{G1} — — — — — —



For frequencies up to 30 MHz

Ordering code Q53-X2031

Vapor-cooled triode with coaxial grid lead-through. Due to the low amplification factor this tube is particularly suitable for use in modulators with low grid current.



RSE0514-R

Dimensions in mm

① 4 tapholes M5 (4 × 90°)
② Taphole M6 for screw-in handle RöZub201K
③ Taphole M5 for tube fuse RöSich4

Approx. weight 34 kg

Heating

Heater voltage	U_F	17	V
Heater current	I_F	≈ 156	A
Heating: direct			
Cathode: thoriated tungsten			

Characteristics

Emission current at $U_A = U_G = 750$ V	I_{em}	125	A
Amplification factor at $U_A = 4$ to 10 kV, $I_A = 5$ A	μ	13,5	
Transconductance at $U_A = 4$ kV, $I_A = 5$ A	S	78	mA/V

Capacitances

Cathode/grid	c_{kg}	≈ 175	pF
Cathode/anode	c_{ka}	≈ 8,0	pF [1])
Grid/anode	c_{ga}	≈ 76	pF

Accessories

		Ordering code
Mounting instruction	RöMo14	
Mounting instruction	RöMo25	
Cathode connecting strip (2 for each tube)	RöKat41	Q81-X1141
Socket wrench for tube fuse	RöZub10	Q81-X2110
Handle	RöZub201K	Q81-X2151
Tube fuse	RöSich4	Q81-X1404
Pull switch for tube fuse	RöKt11	Q81-X1311
Boiler	RöKüV201	Q81-X1671
Union at water inlet	RöKüV41Zub7	Q81-X1647
Insulating pipe at vapor outlet	RöKüV201Zub3	Q81-X1673
Insulating pipe at water inlet	RöKüV201Zub4	Q81-X1674
Insulator	RöKüV201Zub5K	Q81-X1675
Gasket at vapor outlet	RöKüV201Zub8	Q81-X1678
Water level stabilizer with control electrodes	RöZubV4	Q81-X2105
LL electrolytic target	RöEl23	C65055-A667-A23
Gasket for boiler	RöN9355	C65051-A201-C531

1) Measured by means of a 40 cm × 40 cm screening plate in the grid terminal plane.

RF amplifier,
class B operation, grounded cathode circuit

Maximum ratings

Frequency	f	30	MHz
Anode voltage (dc)	U_A	12,5	kV
Grid voltage(dc)	U_G	– 1200	V
Cathode current (dc)	I_K	25	A
Peak cathode current	$I_{K\,M}$	100	A
Anode dissipation	P_A	110	kW
Grid dissipation	P_G	1100	W

Operating characteristics

Frequency	f	≤ 30	≤ 30	MHz
Output power	P_2	165	110	kW [1])
Anode voltage (dc)	U_A	12	10	kV
Grid voltage (dc)	U_G	– 900	– 730	V
Peak control grid voltage (ac)	$U_{g\,m}$	1300	1100	V
Zero signal anode current (dc)	$I_{A\,0}$	1,5	1,5	A
Anode current (dc)	I_A	18,8	15,3	A
Grid current (dc)	I_G	1,6	1,3	A
Anode input power	$P_{B\,A}$	226	153	kW
Drive power	P_1	2,0	1,3	kW [1])
Anode dissipation	P_A	61	43	kW
Grid dissipation	P_G	600	350	W
Efficiency	η	73	72	%
Anode load resistance	R_A	370	370	Ω

1) Circuit losses are not included.

RF amplifier, class C operation, grounded cathode circuit

Maximum ratings

Frequency	f	30	MHz
Anode voltage (dc)	U_A	12,5	kV
Grid voltage (dc)	U_G	– 1500	V
Cathode current (dc)	I_K	25	A
Peak cathode current	$I_{K\,M}$	100	A
Anode dissipation	P_A	110	kW
Grid dissipation	P_G	1100	W

Operating characteristics

Frequency	f	≤ 30	≤ 30	MHz
Output power	P_2	165	110	kW [1])
Anode voltage (dc)	U_A	12	10	kV
Grid voltage (dc)	U_G	– 1350	– 1200	V
Peak grid voltage (ac)	$U_{g\,m}$	1830	1630	V
Anode current (dc)	I_A	17	13,8	A
Grid current (dc)	I_G	2,0	1,8	A
Anode input power	$P_{B\,A}$	204	138	kW
Drive power	P_1	3,3	2,7	kW [1])
Anode dissipation	P_A	39	28	kW
Grid dissipation	P_G	600	500	W
Efficiency	η	81	80	%
Anode load resistance	R_A	370	370	Ω

1) Circuit losses are not included.

AF amplifier and modulator, class B operation, 2 tubes in push-pull circuit

Maximum ratings

Anode voltage (dc)	U_A	12	kV
Grid voltage (dc)	U_G	– 1200	V
Cathode current (dc)	I_K	25	A
Peak cathode current	$I_{K\,M}$	100	A
Anode dissipation	P_A	110	kW
Grid dissipation	P_G	1100	W

Operating characteristics

at modulator operation for

		300 kW carrier power		200 kW carrier power		
Output power	P_2	0	240	0	160	kW
Anode voltage (dc)	U_A	11	11	11	11	kV
Grid voltage (dc)	U_G	– 810	– 810	– 830	– 830	V
Peak control grid voltage (ac) between the 2 tubes	$U_{gg\,m}$	0	2120	0	1980	V
Anode current (dc)	I_A	2 × 1,5	2 × 18	2 × 1	2 × 11,7	A
Grid current (dc)	I_G	0	2 × 0,6	0	2 × 0,25	A
Peak grid current	$I_{G\,M}$	0	2 × 4,3	0	2 × 2,2	A
Anode input power	$P_{B\,A}$	2 × 16,5	2 × 198	2 × 11	2 × 129	kW
Drive power	P_1	0	2 × 600	0	2 × 180	W
Anode dissipation	P_A	2 × 16,5	2 × 78	2 × 11	2 × 49	kW
Grid dissipation	P_G	0	2 × 120	0	2 × 40	W
Efficiency	η	—	61	—	62	%
Effective load resistance (anode to anode)	R_{AA}	—	600	—	950	Ω

Tube mounting

Axis vertical, anode down.

For connection of the cathode use the terminals listed under "Accessories".

A number of M5 tapholes is provided at the grid terminal ring for grid connection; the delivery includes knurled head screws for this purpose.

Maximum tube surface temperature

The temperature of the glass and metal parts and of the cathode terminals must not exceed 220 °C at any point. At $f > 10$ MHz a properly distributed, slight air stream has to be directed onto the grid terminal ring and the cathode terminal pins.

Vapor cooling

Cooling specifications for maximum anode dissipation	$P_{A\,max}$ = 110 kW
Total power to be dissipated by the cooling system ($P_A + P_G + 0{,}8\ P_F$)	114 kW
Equivalent thermal output	6820 kJ/min (1640 kcal/min)
Flow rate of returning water	
at returning water temperature of 20 °C	approx. 2,7 l/min
at returning water temperature of 90 °C	approx. 3,1 l/min
Volume of generated vapor	
at returning water temperature of 20 °C	approx. 4,5 m^3/min
at returning water temperature of 90 °C	approx. 5,1 m^3/min

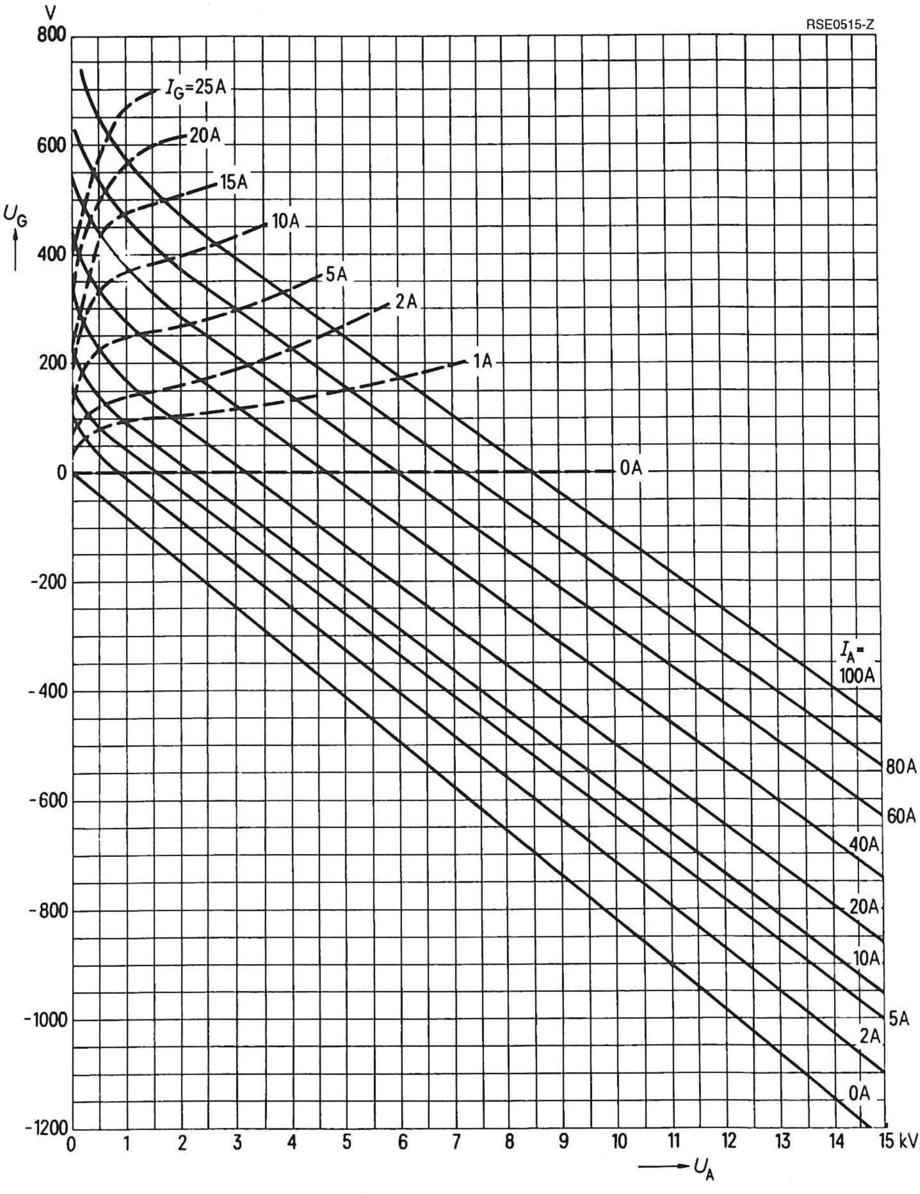
Detailed information on vapor cooling upon request. Please observe instructions on vapor cooling given under "Explanations on Technical Data".

Safety precautions

The section "Safety precautions" under "Explanations on Technical Data" describes how the tube is to be protected against damage due to electric overload or insufficient cooling. A copper wire with 0,24 mm diameter should be used to test the anode overcurrent trip circuit.

For protection against thermal anode overload the tube fuse RöSich4 is recommended. In conjunction with pull switch RöKt11 it disconnects the voltages at the tube in case of overload (accessories).

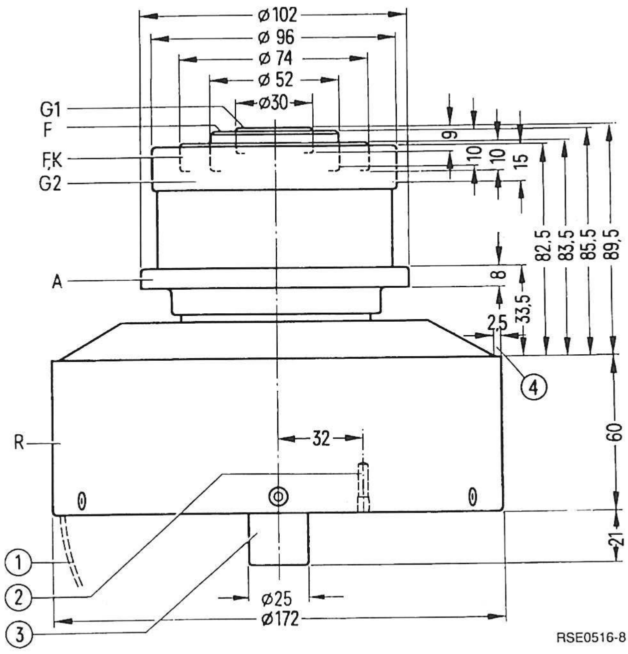
$U_G = f(U_A)$ Parameter = I_A ———— Parameter = I_G – – – –



For FM transmitters in grounded cathode circuit

Ordering code Q51-X2032

Coaxial metal-ceramic tetrode, forced-air-cooled, particularly suitable for FM transmitters in grounded cathode circuit. For an easy design of the tuned circuit the control grid terminal is coaxially led out within the cathode terminals. A direct dc blocking of the screen grid produced by the external cathode terminal is thereby possible. This arrangement of the terminals also prevents cross coupling of the input and output circuit against the common cathode line inductance. An increased stability against self-excitation has been achieved by integrating an attenuator into the screen grid line. This resistor consumes a power of approximately 30 W for an operating frequency of 110 MHz and an output power of 12 kW.



Dimensions in mm

① Handle, swingable
② Taphole for tube fuse RöSich7
③ Do not use as terminal
④ Free for anode support

Approx. weight 6,7 kg

The radiator and the terminals are of concentric design with the following diameters:

Radiator	∅ 173,5	Control grid terminal	∅ 30,6
Anode terminal	∅ 103,0	Heater/cathode terminal	∅ 74,6
Screen grid terminal	∅ 96,6	Heater terminal	∅ 52,5

Heating

Heater voltage	U_F	9,5	V
Heater current	I_F	≈ 80	A
Heating: direct			
Cathode: thoriated tungsten			

Characteristics

Emission current at $U_A = U_{G2} = U_{G1} = 300$ V	I_{em}	35	A
Amplification factor of screen grid at $U_A = 2$ kV, $U_{G2} = 600$ to 1000V, $I_A = 2$ A	μ_{g2g1}	8,0	
Transconductance at $U_A = 2$ kV, $U_{G2} = 800$ V, $I_A = 1,5$ bis 2,5 A	S	53	mA/V

Capacitances

Cathode/control grid	c_{kg1}	≈ 95	pF
Cathode/screen grid	c_{kg2}	≈ 45	pF
Cathode/anode	c_{ka}	≈ 0,04	pF [1])
Control grid/screen grid	c_{g1g2}	≈ 76	pF
Control grid/anode	c_{g1a}	≈ 0,32	pF [1])
Screen grid/anode	c_{g2a}	≈ 22	pF

Accessories		Ordering code
Socket wrench for tube fuse	RöZub09	Q81-X2109
Tube fuse	RöSich7	Q81-X1407
Pull switch for tube fuse	RöKt11	Q81-X1311

1) Measured by means of a 50 cm diameter screening plate in the screen grid terminal plane.

RF amplifier,
class B operation, grounded cathode circuit

Maximum ratings

Frequency	f	110	MHz
Anode voltage (dc)	U_A	9,0	kV
Screen grid voltage (dc)	U_{G2}	1000	V
Control grid voltage (dc)	U_{G1}	– 250	V
Cathode current (dc)	I_K	6,0	A
Peak cathode current	I_{KM}	35	A
Anode dissipation	P_A	12	kW
Screen grid dissipation	P_{G2}	270	W
Control grid dissipation	P_{G1}	70	W

Operating characteristics

Frequency	f	≤ 110	MHz
Output power	P_2	12	kW 1)
Anode voltage (dc)	U_A	7,5	kV
Screen grid voltage (dc)	U_{G2}	800	V
Control grid voltage (dc)	U_{G1}	– 100	V 2)
Peak control grid voltage (ac)	$U_{g1\,m}$	110	V
Anode current (dc)	I_A	2,3	A
Screen grid current (dc)	I_{G2}	200	mA
Control grid current (dc)	I_{G1}	50	mA
Anode input power	P_{BA}	17,2	kW
Drive power	P_1	30	W 3)
Anode dissipation	P_A	5,2	kW
Screen grid dissipation	P_{G2}	160	W
Efficiency	η	70	%
Anode load resistance	R_A	1800	Ω

1) Circuit losses are not included.
2) For zero signal dc anode current I_{A0} = 0,4 A.
3) Additional loss in the grid circuit is not taken into consideration.

Tube mounting

Axis vertical, anode up or down.

The cavity TK 4470 is available for tube operation in the VHF range (accessories).

Maximum tube surface temperature

The metal-ceramic seals of the tube must not exceed a temperature 220 °C at any point, except of the centrally located control grid terminal, the temperature of which must not exceed 280 °C. These requirements can only be met without additional cooling of the terminals if an appropriate air duct and sufficient space between the individual contact springs is provided so that enough cooling air can pass through.

Forced-air cooling

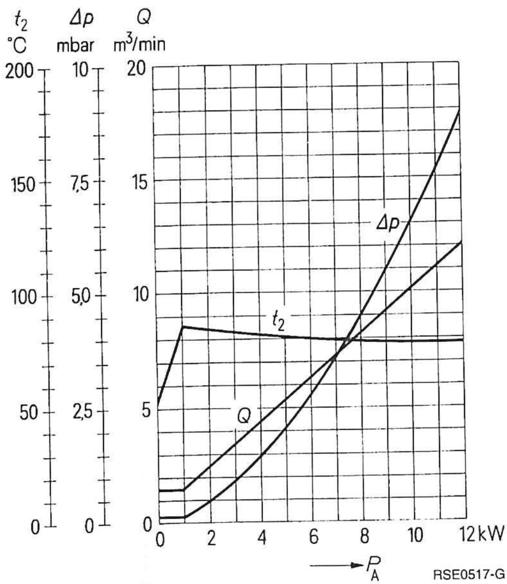
The minimum air flow rate required for maximum anode dissipation is given in the cooling air diagram valid for 25 °C inlet temperature at a normal air pressure of 1 bar (sea level). The cooling air must be supplied from the side of the electrode terminals. For further information on forced air cooling refer to "Explanations on Technical Data".

Safety precautions

The section "Safety precautions" under "Explanations on Technical Data" describes how the tube is to be protected against damage due to electric overload or insufficient cooling. A copper wire with 0,20 mm diameter should be used to test the anode overcurrent trip circuit.

For protection against thermal anode overload the tube fuse RöSich7 is recommended. In conjunction with pull switch RöKt11 it disconnects the voltages at the tube in case of overload (accessories).

Cooling air diagram



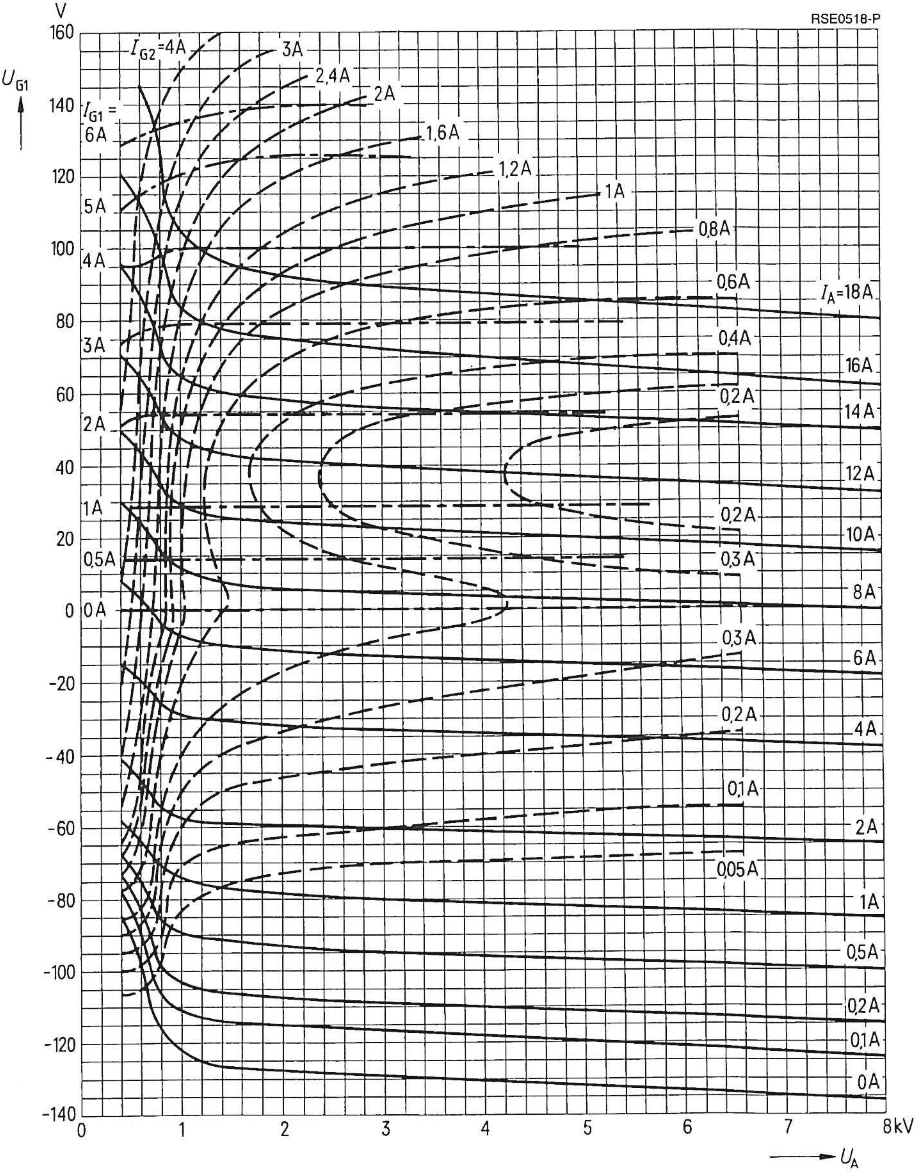
The cooling air is supplied from the electrode terminal side.

Air pressure = 1 bar

t_1 = 25°C

$U_{G1} = f(U_A)$
$U_{G2} = 800$ V

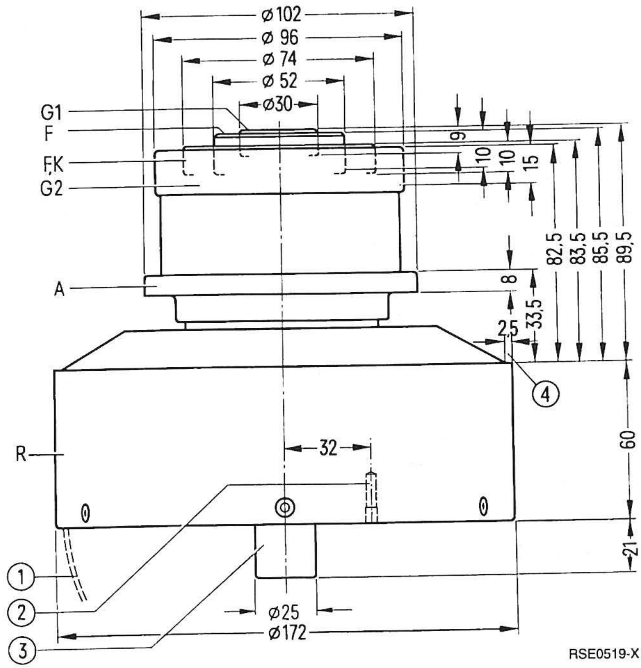
Parameter = I_A ————
Parameter = I_{G2} — — —
Parameter = I_{G1} —·—·—



VX

For VHF transmitters in grounded cathode circuit Ordering code Q51-X2034

Coaxial metal-ceramic tetrode, forced-air-cooled, particularly suitable for VHF satellite transmitters up to 160 MHz/8 kW in grounded cathode circuit with grid-current free modulation. For an easy design of the tuned circuit the control grid terminal is coaxially led out within the cathode terminals. A direct dc blocking of the screen grid produced by the external cathode terminal is thereby possible. This arrangement of the terminals also prevents cross coupling of the input and output circuit against the common cathode line inductance.



Dimensions in mm

RSE0519-X

① Handle, swingable
② Taphole for tube fuse RöSich7
③ Do not use as terminal
④ Free for anode support

Approx. weight 6,7 kg

Radiator and terminals are of concentric design with the following diameters:

Radiator	Ø 173,5	Control grid terminal	Ø 30,6
Anode terminal	Ø 103,0	Heater/cathode terminal	Ø 74,6
Screen grid terminal	Ø 96,6	Heater terminal	Ø 52,5

Heating

Heater voltage	U_F	10	V
Heater current	I_F	≈ 86	A
Heating: direct			
Cathode: thoriated tungsten			

Characteristics

Emission current at $U_A = U_{G2} = U_{G1} = 300$ V	I_{em}	35	A
amplification factor of screen grid at $U_A = 2$ kV, $U_{G2} = 600$ to 1000V, $I_A = 2$ A	μ_{g2g1}	8,0	
Transconductance at $U_A = 2$ kV, $U_{G2} = 800$ V, $I_A = 1{,}5$ to 2,5 A	S	53	mA/V

Capacitances

Cathode/control grid	c_{kg1}	≈ 95	pF
Cathode/screen grid	c_{kg2}	≈ 45	pF
Cathode/anode	c_{ka}	≈ 0,04	pF [1])
Control grid/screen grid	c_{g1g2}	≈ 76	pF
Control grid/anode	c_{g1a}	≈ 0,32	pF [1])
Screen grid/anode	c_{g2a}	≈ 22	pF

Accessories

		Ordering code
Socket wrench for tube fuse	RöZub09	Q81-X2109
Tube fuse	RöSich7	Q81-X1407
Pull switch for tube fuse	RöKt11	Q81-X1311

1) Measured by means of a 50 cm diameter screening plate in the screen grid terminal plane.

RF amplifier,
class B operation, grounded cathode circuit, $I_{G1} = 0$

Maximum ratings

Frequency	f	160	MHz
Anode voltage (dc)	U_A	8,0	kV
Screen grid voltage (dc)	U_{G2}	1000	V
Control grid voltage (dc)	U_{G1}	– 250	V
Peak cathode current	$I_{K\,M}$	35	A
Anode dissipation	P_A	12	kW
Screen grid dissipation	P_{G2}	240	W
Control grid dissipation	P_{G1}	50	W

Operating characteristics

Frequency	f	150	MHz
Output power	P_2	9,0	kW [1])
Anode voltage (dc)	U_A	7,0	kV
Screen grid voltage (dc)	U_{G2}	800	V
Control grid voltage (dc)	U_{G1}	– 100	V [2])
Peak control grid voltage (ac)	$U_{g1\,m}$	100	V
Anode current (dc)	I_A	2,0	A
Screen grid current (dc)	I_{G2}	160	mA
Anode input power	$P_{B\,A}$	14	kW
Anode dissipation	P_A	5,0	kW
Screen grid dissipation	P_{G2}	130	W
Efficiency	η	64	%
Anode load resistance	R_A	2000	Ω

1) Circuit losses are not included.
2) For zero signal dc anode current $I_{A\,0} = 0{,}4$ A.

Tube mounting

Axis vertical, anode up or down.

Maximum tube surface temperature

The metal-ceramic seals of the tube must not exceed a temperature of 220 °C at any point, except of the centrally located control grid terminal, the temperature of which must not exceed 280 °C. These requirements can only be met without additional cooling of the terminals if an appropriate air duct and sufficient space between the individual contact springs is provided so that enough cooling air can pass through.

Forced-air cooling

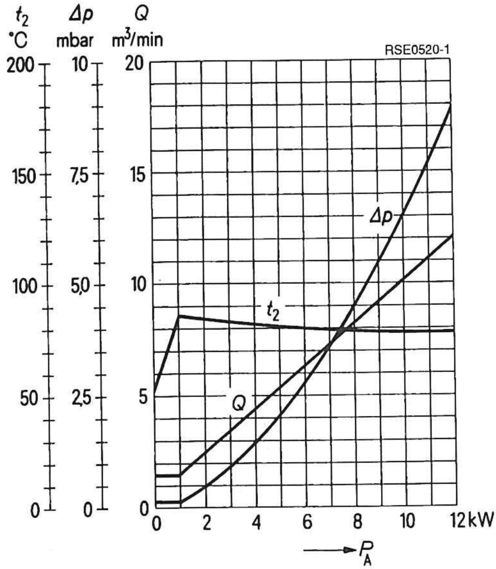
The minimum air flow rate required for maximum anode dissipation is given in the cooling air diagram valid for 25 °C inlet temperature at a normal air pressure of 1 bar (sea level). The cooling air must be supplied from the side of the electrode terminals. For further information on forced air cooling refer to "Explanations on Technical Data".

Safety precautions

The section "Safety precautions" under "Explanations on Technical Data" describes how the tube is to be protected against damage due to electric overload or insufficient cooling. A copper wire with 0,20 mm diameter should be used to test the anode overcurrent trip circuit.

For protection against thermal anode overload the tube fuse RöSich7 is recommended. In conjunction with pull switch RöKt11 it disconnects the voltages at the tube in case of overload (see accessories).

Cooling air diagram



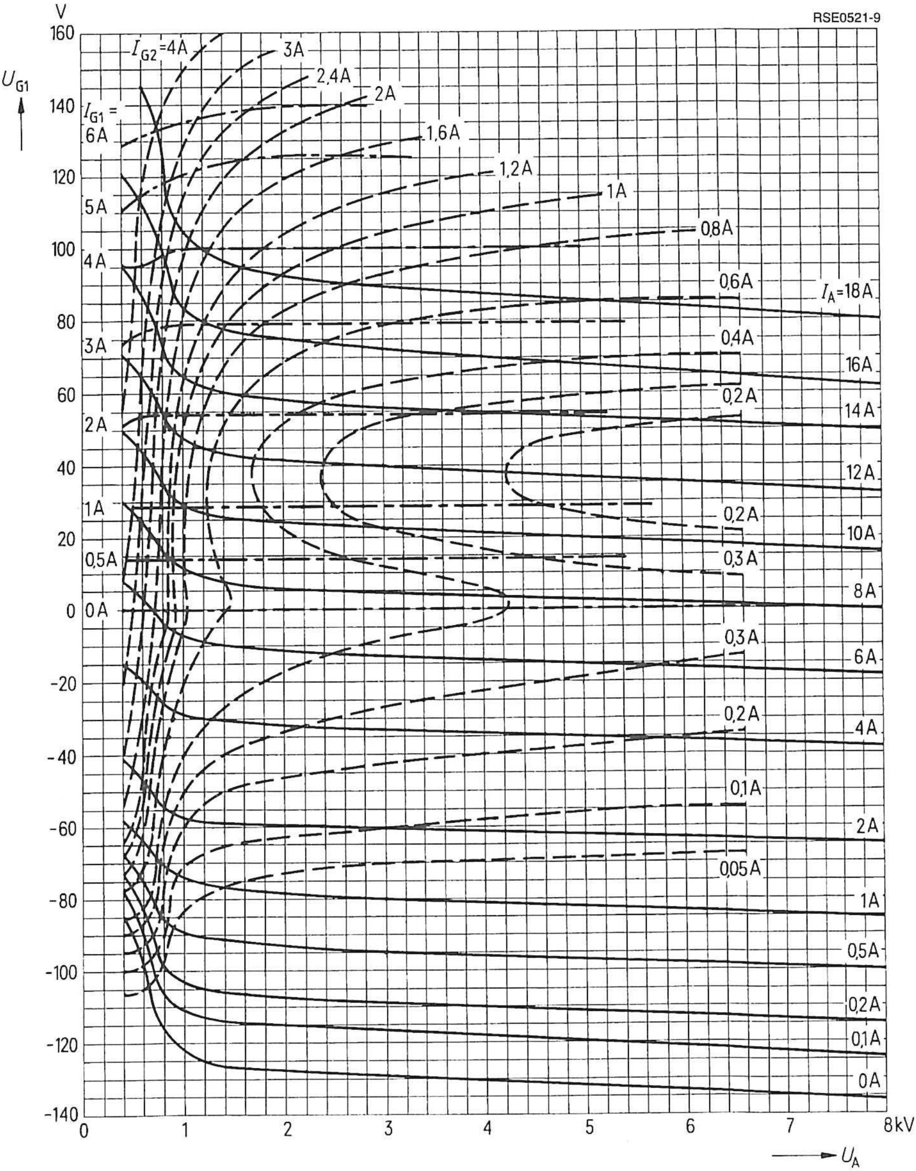
The cooling air is supplied from the electrode terminal side.

Air pressure = 1 bar

t_1 = 25°C

$U_{G1} = f(U_A)$
$U_{G2} = 800$ V

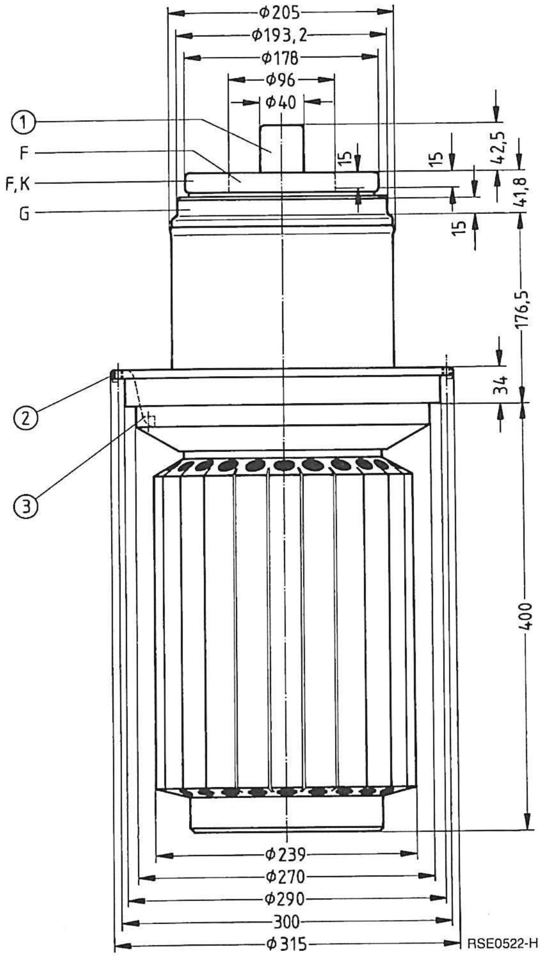
Parameter = I_A ————
Parameter = I_{G2} – – – –
Parameter = I_{G1} —·—·—



VX

Ordering code Q53-X2041

Coaxial triode in metal-glass-ceramic technology, vapor-cooled, suitable for broadcast transmitters up to 300 kW medium and short wave, for modulators in transmitters up to 600 kW and for RF amplifiers up to 600 kW/up to 30 MHz.



Dimensions in mm

① Do not use as terminal
② Taphole M8 for screw-in handle RöZub41V
③ Taphole M5 for tube fuse RöSich4

Approx. weight 66 kg

Heating

Heater voltage	U_F	21	V
Heater current	I_F	≈ 400	A
Heating: direct			
Cathode: thoriated tungsten			

Characteristics

Emission current at $U_A = U_G = 1000$ V	I_{em}	380	A
Amplification factor at $U_A = 4$ to 10 kV, $I_A = 10$ A	μ	35	
Transconductance at $U_A = 4$ kV, $I_A = 10$ A	s	215	mA/V

Capacitances

Cathode/grid	c_{kg}	≈ 330	pF
Cathode/anode	c_{ka}	≈ 6,5	pF [1])
Grid/anode	c_{ga}	≈ 135	pF

Accessories

		Ordering code
Mounting instruction	RöMo104	
Mounting instruction	RöMo105	
Cathode terminal	RöKat202	C65055-A805-A61
Cathode connecting strip (4 for each tube)	RöKat221	Q81-X1136
Grid terminal	RöGit202b	Q81-X953
MW header socket without blocking	RöKpf241MO	Q81-X1843
Socket wrench for tube fuse	RöZub10	Q81-X2110
Handle	RöZub41V	Q81-X2141
Tube fuse	RöSich4	Q81-X1404
Pull switch for tube fuse	RöKt11	Q81-X1311
Boiler	RöKüV241	Q81-X1691
Insulating pipe at vapor outlet	RöKüV241Zub3	Q81-X1693
Insulating pipe at water inlet	RöKüV241Zub4	Q81-X1694
Insulator	RöKüV241Zub5K	Q81-X1695
Union at water inlet	RöKüV241Zub7	Q81-X1697
Gasket at vapor outlet	RöKüV241Zub8	Q81-X1698
Water level stabilizer with control electrodes	RöZubV4	Q81-X2105
Grid and cathode terminals with protective gaps (complete set)	RöKG241	Q81-X1001
LL electrolytic target	RöEl24	C65055-A667-A24
Gasket ring for boiler	RöN9374	C65051-A202-C553

1) Measured by means of a 50 cm × 50 cm screening plate in the screen grid terminal plane.

VX

RF amplifier,
class C operation, grounded cathode circuit

Maximum ratings

Frequency	f	10	30	MHz
Anode voltage (dc)	U_A	19	15	kV
Grid voltage (dc)	U_G	– 1200	– 1200	V
Cathode current (dc)	I_K	60	60	A
Peak cathode current	$I_{K\,M}$	340	340	A
Anode dissipation	P_A	220	220	kW
Grid dissipation	P_G	7	5	kW

Operating characteristics

Frequency	f	≤ 10	≤ 30	≤ 30	MHz
Output power	P_2	660	530	440	kW [1])
Anode voltage (dc)	U_A	18	14	12	kV
Grid voltage (dc)	U_G	– 1000	– 800	– 800	V
Peak grid voltage (ac)	$U_{g\,m}$	1620	1420	1420	V
Anode current (dc)	I_A	45	46	46	A
Grid current (dc)	I_G	7,5	7,5	7,5	A
Anode input power	$P_{B\,A}$	810	650	550	kW
Drive power	P_1	11	9,6	9,6	kW [1])
Anode dissipation	P_A	150	120	110	kW
Grid dissipation	P_G	3,5	3,6	3,6	kW
Efficiency	η	81	81	80	%
Anode load resistance	R_A	220	160	135	Ω

1) Circuit losses are not included.

Anode voltage modulation,
50 % modulated driver stage, grounded cathode circuit

Maximum ratings

Frequency	f	10	MHz
Anode voltage (dc)	U_A	11,5	kV
Grid voltage (dc)	U_G	– 1200	V
Cathode current (dc)	I_K	60	A
Peak cathode current	$I_{K\,M}$	380	A
Anode dissipation	P_A	220	kW
Grid dissipation	P_G	7,0	kW

Operating characteristics

Frequency	f	≤ 10	≤ 10	MHz
Carrier power	P_{trg}	330	280	kW 1)
Anode voltage (dc)	U_A	11	11	kV
Grid bias (dc), fixed	$U_{G\,fix}$	– 530	– 430	V
Grid resistance	R_G	20	26	Ω
Peak grid voltage (ac)	$U_{g\,m}$	1240	1120	V
Anode current (dc)	I_A	37	31,5	A
Grid current (dc)	I_G	8,5	8,0	A
Anode input power	$P_{B\,A}$	407	348	kW
Drive power	P_1	9,5	8,0	kW 1)
Anode dissipation	P_A	77	68	kW 2)
Grid dissipation	P_G	3,6	2,9	kW
Efficiency	η	81	81	%
Anode load resistance	R_A	160	200	Ω
Modulation factor	m	100	100	%
Modulation power	P_{mod}	204	174	kW
Grid dissipation at modulation	$P_{G\,mod}$	5,2	4,5	kW 3)
Peak grid voltage (ac)	$U_{g\,m}$	1860	1680	V 4)
Grid current	I_G	16	15	A 4)
Drive power	P_1	28	24	kW 1) 4)

1) Circuit losses are not included.
2) Even during modulation the indicated maximum ratings must not be exceeded. It has to be observed that during 100 % modulation the anode dissipation increases to about 1,5 times the power dissipation stated for the carrier value.
3) Average value at m = 100 %.
4) Maximum values at peak modulation.

Anode voltage modulation, 50 % modulated driver stage, grounded cathode circuit

Maximum ratings

Frequency	f	30	MHz
Anode voltage (dc)	U_A	11,5	kV
Grid voltage (dc)	U_G	– 1200	V
Cathode current (dc)	I_K	60	A
Peak cathode current	$I_{K\,M}$	380	A
Anode dissipation	P_A	220	kW
Grid dissipation	P_G	5,0	kW

Operating characteristics

Frequency	f	≤ 30	MHz
Carrier power	P_{trg}	252 + 28 [2])	kW [1])
Anode voltage (dc)	U_A	11	kV
Grid bias (dc), fixed	$U_{G\,fix}$	– 370	V
Grid resistance	R_G	33	Ω
Peak grid voltage (ac)	$U_{g\,m}$	1040	V
Anode current (dc)	I_A	28,4	A
Grid current (dc)	I_G	7,0	A
Anode input power	$P_{B\,A}$	312	kW
Drive power	P_1	6,6 + 28 [2])	kW [1])
Anode dissipation	P_A	60	kW [3])
Grid dissipation	P_G	2,4	kW
Efficiency	η	81	%
Anode load resistance	R_A	210	Ω
Modulation factor	m	100	%
Modulation power	P_{mod}	156	kW
Grid dissipation at modulation	$P_{G\,mod}$	3,4	kW [4])
Peak grid voltage (ac)	$U_{g\,m}$	1570	V [5])
Grid current (dc)	I_G	13	A [5])
Drive power	P_1	19 + 86 [2])	kW[1])[5])

1) Circuit losses are not included.
2) Power transition of the grounded grid circuit.
3) Even during modulation the indicated maximum ratings must not be exceeded. It has to be observed that during 100 % modulation the anode dissipation increases to about 1,5 times the power dissipation stated for the carrier value.
4) Average value at m = 100 %.
5) Maximum values at peak modulation.

AF amplifier and modulator, class B operation, 2 tubes in push-pull circuit

Maximum ratings

Anode voltage (dc)	U_A	15	kV
Grid voltage (dc)	U_G	– 1200	V
Cathode current (dc)	I_K	60	A
Peak cathode current	I_{KM}	340	A
Anode dissipation	P_A	220	kW
Grid dissipation	P_G	7,0	kW

Operating characteristics

at modulator operation for

		600 kW carrier power		
Output power	P_2	0	410	kW
Anode voltage (dc)	U_A	11	11	kV
Grid voltage (dc)	U_G	– 280	– 280	V
Peak control grid voltage (ac) between the 2 tubes	$U_{gg\,m}$	0	1140	V
Anode current (dc)	I_A	2 × 3	2 × 30	A
Grid current (dc)	I_G	0	2 × 2,3	A
Peak grid current	I_{GM}	0	2 × 14	A
Anode input power	P_{BA}	2 × 33	2 × 330	kW
Drive power	P_1	0	2 × 1,2	kW
Anode dissipation	P_A	2 × 33	2 × 125	kW
Grid dissipation	P_G	0	2 × 550	W
Efficiency	η	—	62	%
Effective load resistance (anode to anode)	R_{AA}	—	400	Ω

Tube mounting

Axis vertical, anode down.

For connection of the tube use the terminals listed under "Accessories". The complete header sockets are intended for transmitter operation, where as the individual connectors are to be used for modulator operation (complete terminal set RöKG241).

Maximum tube surface temperature

The temperature of the glass bulb and of the glass-metal seals must not exceed 180 °C at any point. In SW transmitters using single-sided resonant circuits, the glass bulb will be unilaterally heated by RF reactive currents. Additional cooling of the glass bulb is necessary to ensure that the temperature on this side will not exceed 180 °C.

The maximum temperature of the metal-ceramic seals is 220 °C. When using the individual terminals for modulators, an air flow rate of approx. 5 m^3/min is required in order to maintain these maximum temperatures.

The header sockets for transmitter operation are provided with a centrally located cooling air terminal allowing uniform cooling air distribution over the terminal parts. The cooling air amount necessary for keeping below the specified temperatures lies between 0,5 and 1 m^3/min, according to the operating frequency. The pressure drop is approx. 3,5 mbar for 1 m^3/min.

Vapor cooling

Cooling specifications for maximum anode dissipation	$P_{A\,max}$ = 220 kW
Total power to be dissipated by the cooling system ($P_A + P_G + 0{,}8\ P_F$)	234 kW
Equivalent thermal output	14040 kJ/min (3350 kcal/min)
Flow rate of returning water at returning water temperature of 20 °C at returning water temperature of 90 °C	 approx. 5,4 l/min approx. 6,1 l/min
Volume of generated vapor at returning water temperature of 20 °C at returning water temperature of 90 °C	 approx. 9,0 m^3/min approx. 10,2 m^3/min

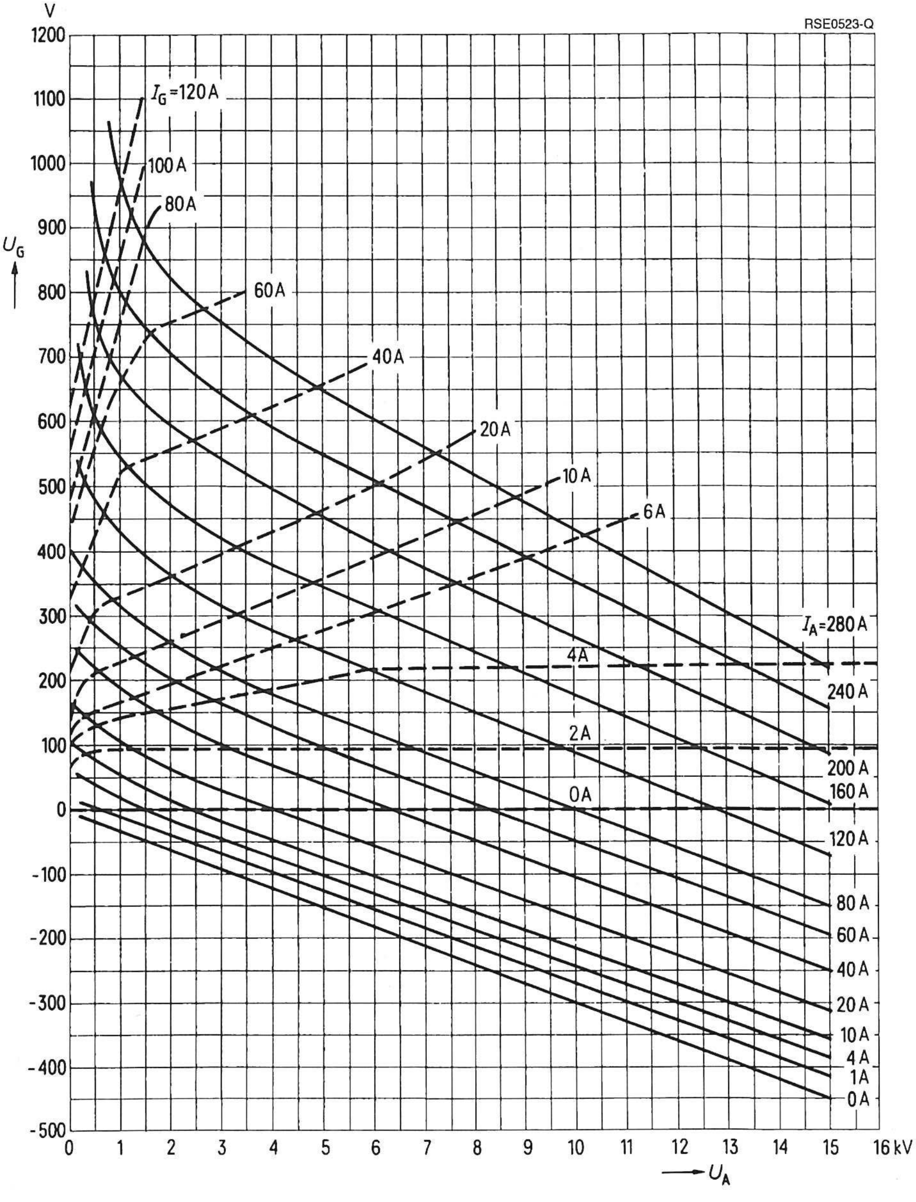
Detailed information on vapor cooling upon request. Please observe instructions on vapor cooling given under "Explanations on Technical Data".

Safety precautions

The section "Safety precautions" under "Explanations on Technical Data" describes how the tube is to be protected against damage due to electric overload or insufficient cooling. A copper wire with 0,30 mm diameter should be used to test the anode overcurrent trip circuit.

For protection against thermal anode overload the tube fuse RöSich4 is recommended. In conjunction with pull switch RöKt11 it disconnects the voltages at the tube in case of overload (accessories).

$U_G = f(U_A)$ Parameter = I_A ————
Parameter = I_G – – – –

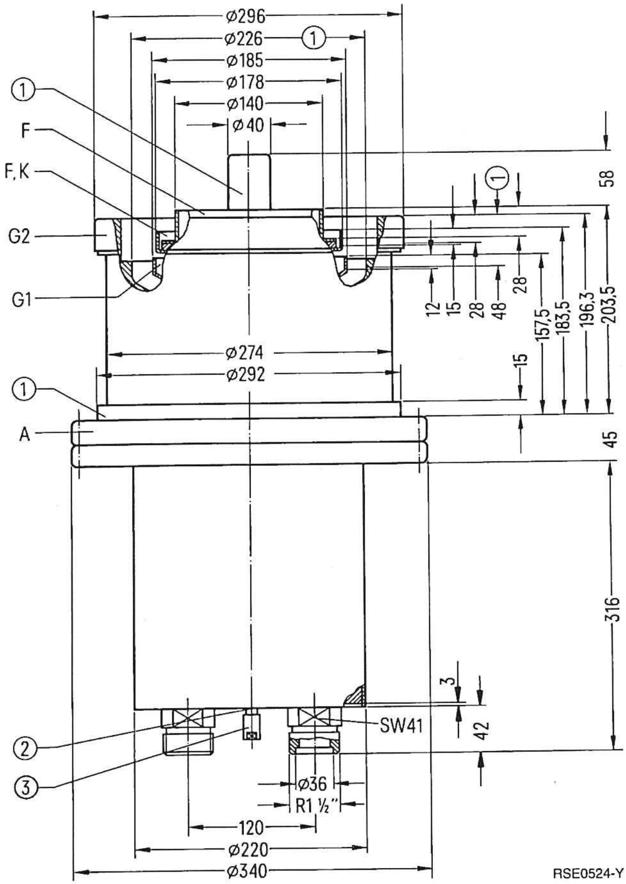


Ordering code Q53-X2042 (RS 2042 SK)
Ordering code Q53-X242 (RS 2042 HF)

Coaxial metal-ceramic tetrode, vapor-condensation-cooled.

The version RS 2042 SK is particularly suitable for broadcast transmitters up to 300 kW medium wave and 250 kW short wave, for grid-current free operated modulators in transmitters up to 600 kW, and for use as switching tube in PDM transmitters up to 600 kW.

The version RS 2042 HF is particularly suitable for RF amplifiers up to 450 kW/up to 170 MHz.



RSE0524-Y

Dimensions in mm

① Do not use as terminal
② Taphole M12 for screw ring conveyor RöZub105
③ Connector for drain hose with 5 mm internal width

Approx. weight 65 kg

Heating

Heater voltage	U_F	8,5	V
Heater current	I_F	≈ 920	A
Permissible starting current	I_{FM}	≤ 3000	A
Heating: direct			
Cathode: thoriated tungsten			

Characteristics

Emission current at $U_A = U_{G2} = U_{G1} = 600$ V	I_{em}	300	A
Amplification factor of screen grid at $U_A = 6$ kV, $U_{G2} = 800$ to 1200 V, $I_A = 20$ A	μ_{g2g1}	4,5	
Transconductance at $U_A = 6$ kV, $U_{G2} = 1100$ V, $I_A = 20$ A	s	220	mA/V

Capacitances

Cathode/control grid	c_{kg1}	≈ 315	pF
Cathode/screen grid	c_{kg2}	≈ 35	pF
Cathode/anode	c_{ka}	≈ 1,1	pF [1])
Control grid/screen grid	c_{g1g2}	≈ 450	pF
Control grid/anode	c_{g1a}	≈ 4,5	pF [1])
Screen grid/anode	c_{g2a}	≈ 100	pF

Accessories

		Ordering code
Cathode connecting strip (4 for each tube)	RöKat272	Q81-X1109
Header socket with blocking	RöKpf274K	Q81-X1828
Header socket without blocking	RöKpf274OC	Q81-X1862
Screw ring conveyor	RöZub105	Q1001-X148
Insulating hose	RöZub274SK	Q81-X2178
LL electrolytic target for 1 1/4″ hose	RöEl7	Q81-X512

1) Measured by means of a 60 cm diameter screening plate in the screen grid terminal plane.

RF amplifier,
class B operation, grounded control-grid screen-grid circuit

Maximum ratings

Frequency	f	55	MHz
Anode voltage (dc)	U_A	23	kV
Screen grid voltage (dc)	U_{G2}	1600	V
Control grid voltage (dc)	U_{G1}	– 1200	V
Cathode current (dc)	I_K	50	A
Peak cathode current	$I_{K\,M}$	300	A
Anode dissipation	P_A	300	kW [3]
Screen grid dissipation	P_{G2}	4,0	kW
Control grid dissipation	P_{G1}	1,5	kW

Operating characteristics

Frequency	f	50	MHz
Output power	P_2	320 + 13,7 [2]	kW [1]
Anode voltage (dc)	U_A	12	kV
Screen grid voltage (dc)	U_{G2}	1100	V
Control grid voltage (dc)	U_{G1}	– 400	V
Peak control grid voltage (ac)	$U_{g1\,m}$	540	V
Anode current (dc)	I_A	40,5	A
Screen grid current (dc)	I_{G2}	1,0	A
Control grid current (dc)	I_{G1}	0,6	A
Anode input power	$P_{B\,A}$	485	kW
Drive power	P_1	0,3 + 13,7 [2]	kW [1]
Anode dissipation	P_A	165	kW
Screen grid dissipation	P_{G2}	1100	W
Control grid dissipation	P_{G1}	60	W
Efficiency	η	66	%
Anode load resistance	R_A	181	Ω

1) Circuit losses are not included.
2) Power transition of grounded control-grid screen-grid circuit.
3) Higher max. ratings may be released upon request.

RF amplifier, pulse operation, class B operation, grounded control-grid screen-grid circuit

Maximum ratings

Frequency	f	150	MHz
Anode voltage (dc)	U_A	17	kV
Screen grid voltage (dc)	U_{G2}	1600	V
Control grid voltage (dc)	U_{G1}	– 1200	V
Cathode current (dc)	I_K	50	A
Peak cathode current	$I_{K\,M}$	300	A
Anode dissipation	P_A	300	kW [3])
Screen grid dissipation	P_{G2}	4,0	kW
Control grid dissipation	P_{G1}	1,5	kW

Operating characteristics

Frequency	f	≤ 150	MHz
Pulse duration	t_p	$0{,}4 \times 10^{-3}$	s
Pulse seperation	t_0	$0{,}6 \times 10^{-3}$	s
Pulse output power	$P_{2\,p}$	400 + 16 [2])	kW [1])
Anode voltage (dc)	U_A	15	kV
Screen grid voltage (dc)	U_{G2}	1100	V
Control grid voltage (dc)	U_{G1}	– 430	V
Peak pulse control grid voltage (ac)	$U_{g1\,m\,p}$	250	V
Pulse anode current (dc)	$I_{A\,p}$	42	A
Pulse screen grid current	$I_{G2\,p}$	1,0	A
Pulse control grid current (dc)	$I_{G1\,p}$	0,7	A
Pulse anode input power	$P_{B\,A\,p}$	630	kW
Pulse drive power	$P_{1\,p}$	16	kW [1])
Pulse anode dissipation	$P_{A\,p}$	230	kW
Pulse screen grid dissipation	$P_{G2\,p}$	1100	W
Pulse control grid dissipation	$P_{G1\,p}$	60	W
Pulse efficiency	η_p	63	%
Anode load resistance	R_A	190	Ω

1) Circuit losses are not included.
2) Power transition of grounded control-grid screen-grid circuit.
3) Higher max. ratings may be released upon request.

Anode and screen-grid modulation, class C operation, grounded cathode circuit

Maximum ratings

Frequency	f	30	MHz
Anode voltage (dc)	U_A	15	V
Screen grid voltage (dc)	U_{G2}	2200	V
Control grid voltage (dc)	U_{G1}	– 1200	V
Cathode current (dc)	I_K	50	A
Peak cathode current	I_{KM}	300	A
Anode dissipation	P_A	300	kW 5)
Screen grid dissipation	P_{G2}	5,0	kW
Control grid dissipation	P_{G1}	1,5	kW

Operating characteristics

Frequency	f	≤ 30	MHz
Carrier power	P_{trg}	325	kW 1)
Anode voltage (dc)	U_A	12	kV
Screen grid voltage (dc)	U_{G2}	1100	V
Control grid bias (dc), fixed	$U_{G1\,fix}$	– 450	V
Control grid resistance	R_{G1}	65	Ω
Peak control grid voltage (ac)	$U_{g1\,m}$	900	V
Anode current (dc)	I_A	33	A
Screen grid current (dc)	I_{G2}	2,5	A
Control grid current (dc)	I_{G1}	4,0	A
Anode input power	P_{BA}	396	kW
Drive power	P_1	3,5	kW 1)
Anode dissipation	P_A	71	kW 2)
Screen grid dissipation	P_{G2}	2,75	kW
Control grid dissipation	P_{G1}	0,7	kW
Efficiency	η	82	%
Anode load resistance	R_A	180	Ω
Modulation factor	m	100	%
Peak screen grid voltage (ac)	$U_{g2\,m}$	650	V
Modulation power	P_{mod}	208	kW
Control grid current (dc)	I_{G1}	4,8	A 3)
Drive power	P_1	4,0	kW 1) 3)
Anode dissipation at modulation	$P_{A\,mod}$	116	kW 4)
Screen grid dissipation at modulation	$P_{G2\,mod}$	3,1	kW 4)

1) Circuit losses are not included.
2) Even during modulation the indicated maximum ratings must not be exceeded. It has to be observed that during 100 % modulation the anode dissipation increases to about 1,5 times the power dissipation stated for the carrier value.
3) Maximum values at $U_A = 0$ V.
4) Average value at m = 100 %.
5) Higher max. ratings may be released upon request.

AF amplifier and modulator,
class B operation, 2 tubes in push-pull circuit, $I_{G1} = 0$

Maximum ratings

Anode voltage (dc)	U_A	15	kV
Screen grid voltage (dc)	U_{G2}	2200	V
Control grid voltage (dc)	U_{G1}	– 1200	V
Cathode current (dc)	I_K	50	A
Peak cathode current	I_{KM}	300	A
Anode dissipation	P_A	300	kW [1]
Screen grid dissipation	P_{G2}	5,0	kW
Control grid dissipation	P_{G1}	1,5	kW

Operating characteristics

at modulator operation for

		600 kW carrier power		
Output power	P_2	0	373	kW
Anode voltage (dc)	U_A	12	12	kV
Screen grid voltage (dc)	U_{G2}	1400	1400	V
Control grid voltage (dc)	U_{G1}	– 490	– 490	V
Peak control grid voltage (ac) between the 2 tubes	$U_{gg\,m}$	0	880	V
Anode current (dc)	I_A	2 × 1,4	2 × 23,3	A
Screen grid current (dc)	I_{G2}	0	2 × 2	A
Anode input power	P_{BA}	2 × 16,8	2 × 279	kW
Anode dissipation	P_A	2 × 16,8	2 × 92,5	kW
Screen grid dissipation	P_{G2}	0	2 × 2,8	kW
Efficiency	η	—	66,8	%
Effective load resistance (anode to anode)	R_{AA}	—	560	Ω

1) Higher max. ratings may be released upon request.

Tube mounting

Axis vertical, anode up or down.

For connection of the tube use the terminals listed under "Accessories".

Maximum tube surface temperature

The maximum temperature of the tube surface must not exceed 220 °C. The maximum permissible temperature difference at the tube circumference is 50 °C. The temperature drop at the tube must not exceed 25 °C/cm. The surface temperature will remain below the maximum values if an air stream of approx. 5 to 6 m^3/min is directed onto the tube terminals.

Vapor condensation cooling

The cooling water diagram gives the minimum water flow rate (distilled or deionized water) for maximum anode dissipation, as well as pressure drop and water outlet temperature at 60 °C water inlet temperature. The diagram applies to a hermetically sealed cooling system with 1,5 bar overpressure at the cooling water outlet with a maximum permissible outlet temperature of 100 °C.

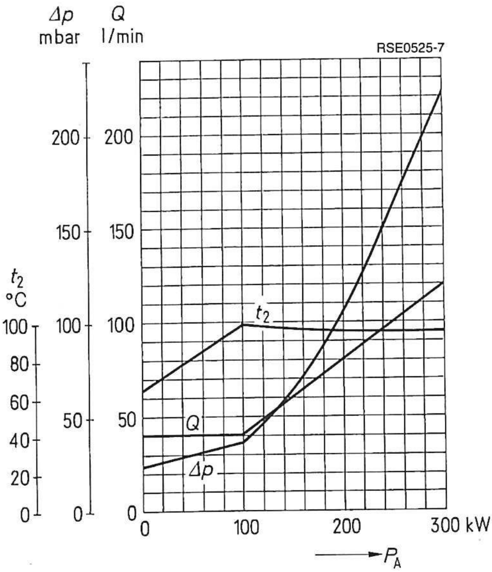
Operation with open cooling cycle (without overpressure) is possible if the maximum outlet temperature remains below 60 °C (sea level, air pressure ≈ 1 bar) with lower inlet temperature and, if required, increased water flow rate.

For more information on vapor condensation cooling refer to "Explanations on Technical Data".

Safety precautions

The section "Safety precautions" under "Explanations on Technical Data" describes how the tube is to be protected against damage due to electric overload or insufficient cooling. A copper wire with 0,40 mm diameter should be used to test the anode overcurrent trip circuit.

Cooling water diagram



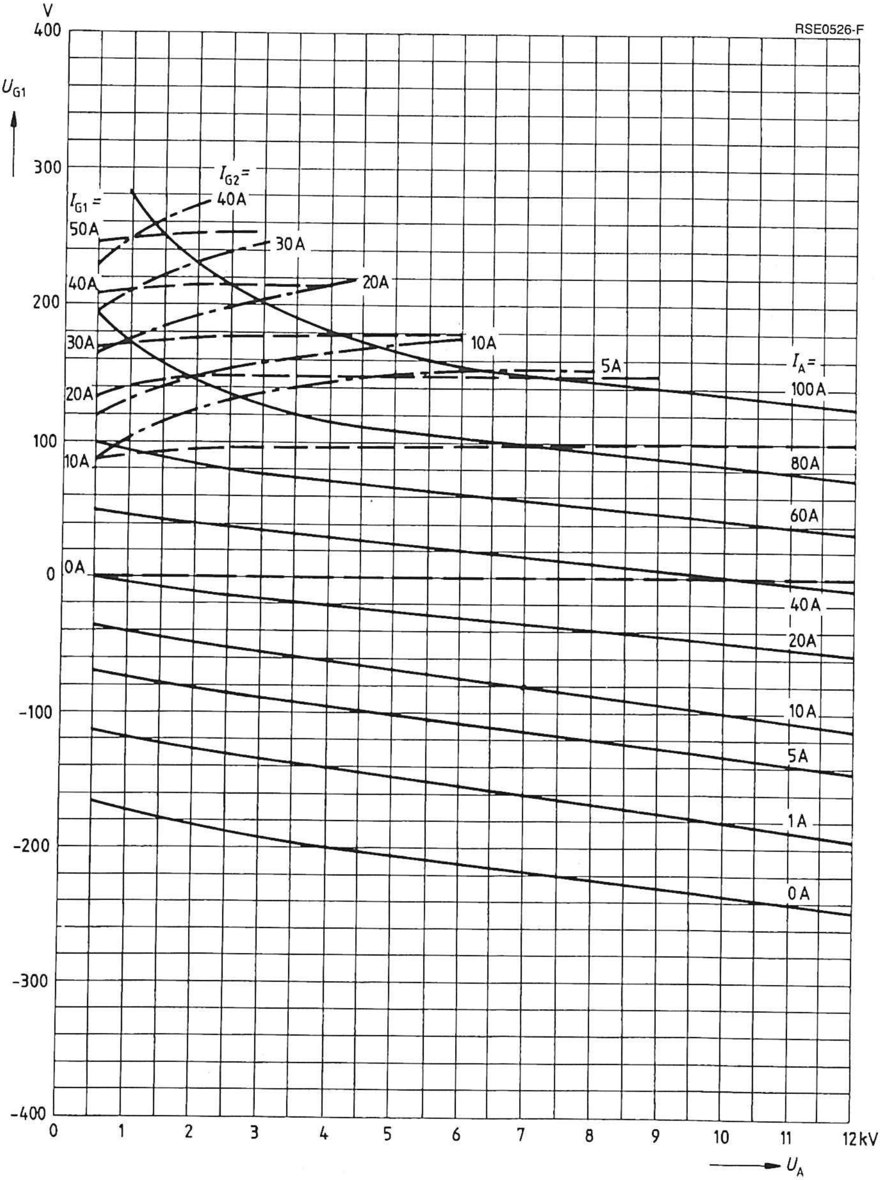
Hermetically sealed cooling system with destilled water.

Overpressure = 1,5 bar

t_1 = 60 °C

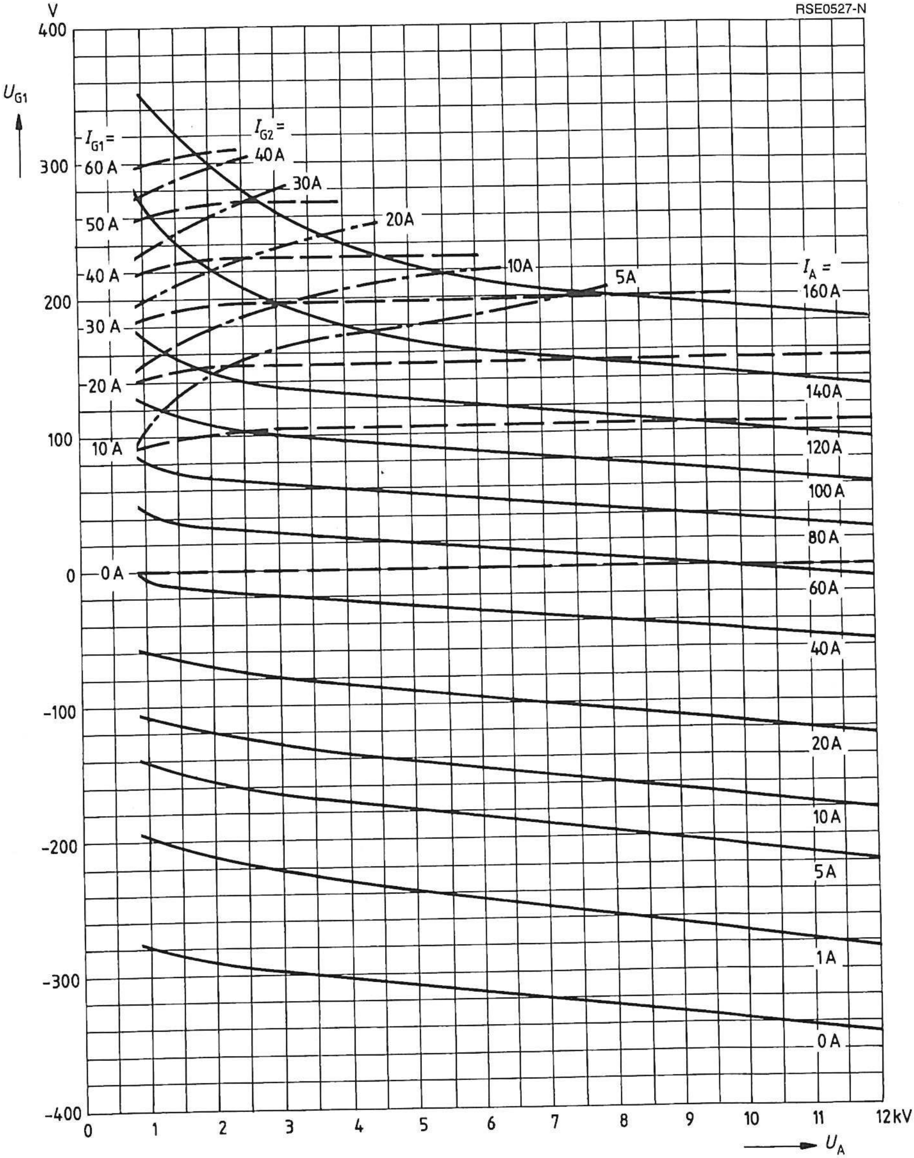
$U_{G1} = f(U_A)$
$U_{G2} = 500$ V

Parameter = I_A ————
Parameter = I_{G2} —·—·—·—
Parameter = I_{G1} — — — —



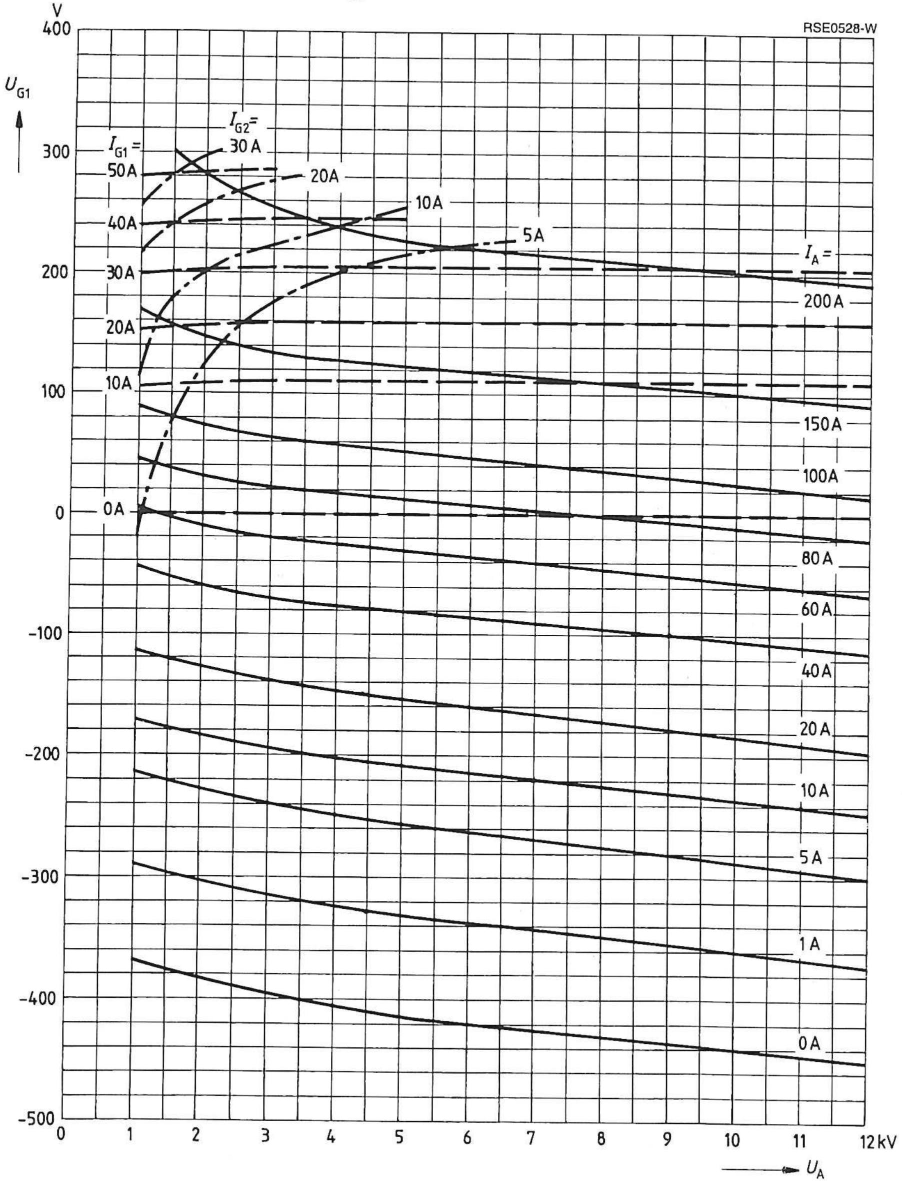
$U_{G1} = f(U_A)$
$U_{G2} = 800$ V

Parameter = I_A ———
Parameter = I_{G2} —·—·—
Parameter = I_{G1} — — —



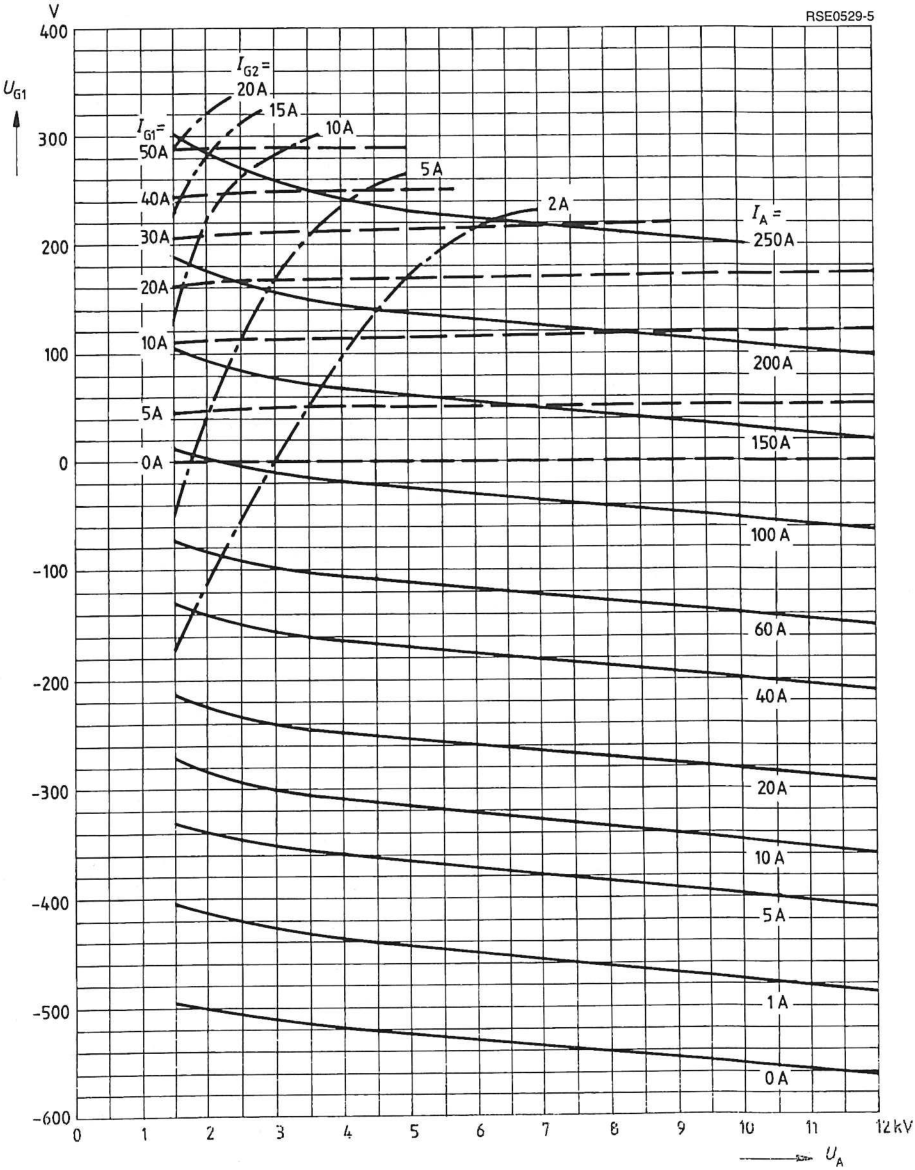
$U_{G1} = f(U_A)$
$U_{G2} = 1100$ V

Parameter = I_A ————————
Parameter = I_{G2} —·—·—·—·—
Parameter = I_{G1} — — — — — —



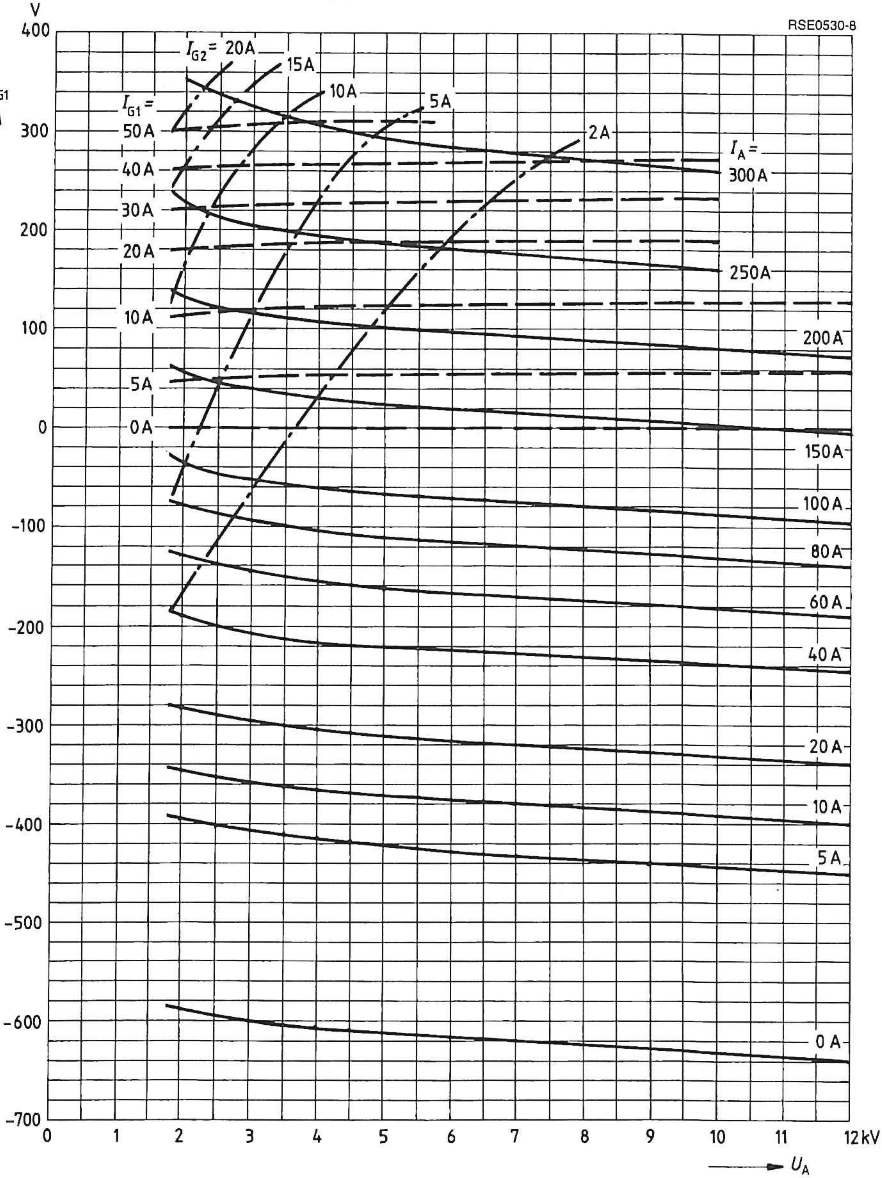
$U_{G1} = f(U_A)$
$U_{G2} = 1500$ V

Parameter = I_A ———
Parameter = I_{G2} —·—·—
Parameter = I_{G1} — — —



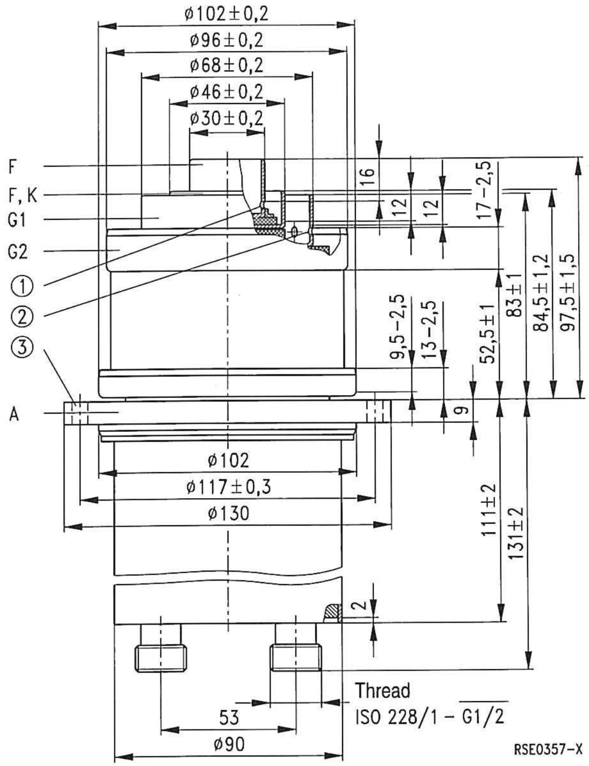
$U_{G1} = f(U_A)$
$U_{G2} = 1750$ V

Parameter = I_A ————
Parameter = I_{G2} —·—·—·—
Parameter = I_{G1} — — — —



Ordering code Q53-2048

Compact, coaxial metal-ceramic tetrode, water-cooled. Due to the low feedback capacitance particularly suitable for high power gain in grounded cathode circuits.



Dimensions in mm

①8 tapholes 3 mm dia.
②12 tapholes 3 mm dia.
③6 tapholes 7 mm dia.

Approx. weight 4,4 kg

Heating

Heater voltage	U_F	9,0	V
Heater current	I_F	≈ 112	A
Heating: direct			
Cathode: thoriated tungsten			

Characteristics

Emission current at $U_A = U_{G2} = U_{G1} = 300$ V	I_{em}	40	A
Amplification factor of screen grid at $U_{G2} = 600$ to 1000 V, $U_A = 2$ kV, $I_A = 3$ A	μ_{g2g1}	7,0	
Transconductance at $U_A = 2$ kV, $U_{G2} = 800$ V, $I_A = 2$ bis 4 A	s	70	mA/V

Capacitances

Cathode/control grid	c_{kg1}	≈ 76	pF
Cathode/screen grid	c_{kg2}	≈ 6	pF
Cathode/anode	c_{ka}	≈ 0,09	pF [1])
Control grid/screen grid	c_{g1g2}	≈ 112	pF
Control grid/anode	c_{g1a}	≈ 0,8	pF [1])
Screen grid/anode	c_{g2a}	≈ 21	pF

Accessories

Upon request

1) Measured by means of a 50 cm diameter screening plate in the screen grid terminal plane.

RF amplifier, class C operation, grounded cathode circuit

Maximum ratings

Frequency	f	50	110	MHz
Anode voltage (dc)	U_A	14	14	kV
Screen grid voltage (dc)	U_{G2}	1000	1000	V
Control grid voltage (dc)	U_{G1}	– 300	– 300	V
Cathode current (dc)	I_K	7	7	A
Peak cathode current	$I_{K\,M}$	35	35	A
Anode dissipation	P_A	30	30	kW
Control grid dissipation	P_{G1}	70	70	W
Screen grid dissipation	P_{G2}	300	250	W

Operating characteristics

Frequency	f	< 50	< 110	MHz
Output power	P_2	53	37,5	kW [1]
Anode voltage (dc)	U_A	12	10	kV
Screen grid voltage (dc)	U_{G2}	800	800	V
Control grid voltage (dc)	U_{G1}	– 230	– 220	V
Peak control grid voltage (ac)	$U_{g1\,m}$	320	300	V
Anode current (dc)	I_A	5,6	4,9	A
Screen grid current (dc)	I_{G2}	0,22	0,19	A
Control grid current (dc)	I_{G1}	0,6	0,55	A
Anode input power	$P_{B\,A}$	67	49	kW
Drive power	P_1	180	140	W [1]
Anode dissipation	P_A	14	11	kW
Screen grid dissipation	P_{G2}	176	152	W
Control grid dissipation	P_{G1}	45	33	W
Efficiency	η	79	77	%
Anode load resistance	R_A	1160	1080	Ω

1) Circuit losses are not included.

Tube mounting

Axis vertical, anode up or down.

Maximum tube surface temperature

The temperature of the metal-ceramic seals must not exceed 220 °C at any point. Sufficient cooling of the terminal side has to be provided by an air flow of approx. 0,7 m^3/min.

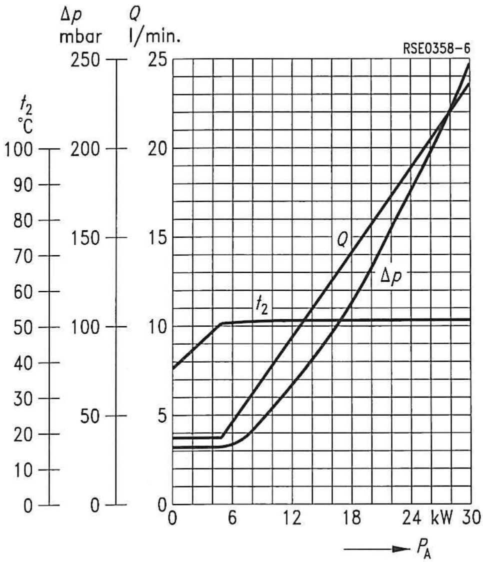
Water cooling

The cooling water diagram is valid for a water inlet temperature of 35 °C. The maximum permissible pressure of the cooling water at the water inlet is 6 bar. Please observe the instructions on water cooling given under „Explanations on Technical Data“.

Safety precautions

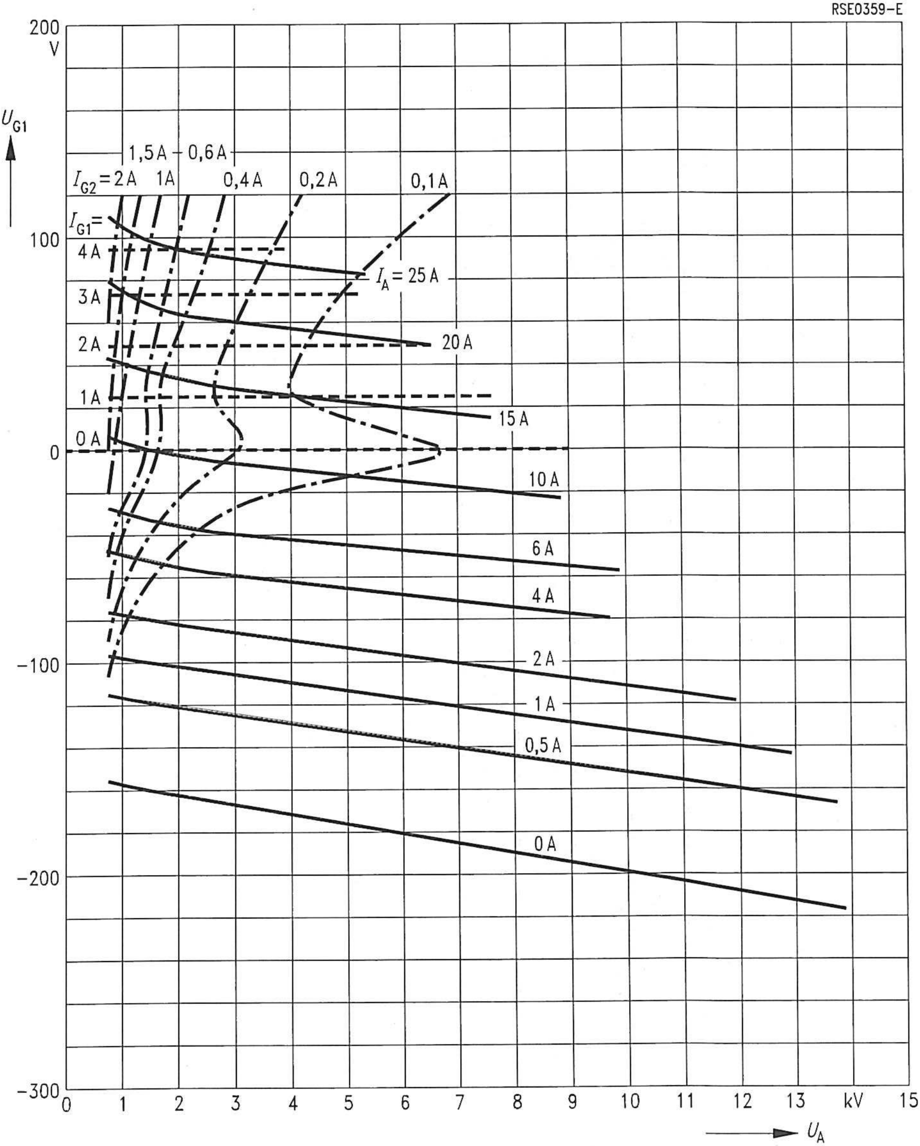
The section "Safety precautions" under "Explanations on Technical Data" describes how the tube is to be protected against damage due to electric overload or insufficient cooling. A copper wire with 0,25 mm diameter should be used to test the anode overcurrent trip circuit.

Cooling water diagram



$t_1 = 35\ °C$

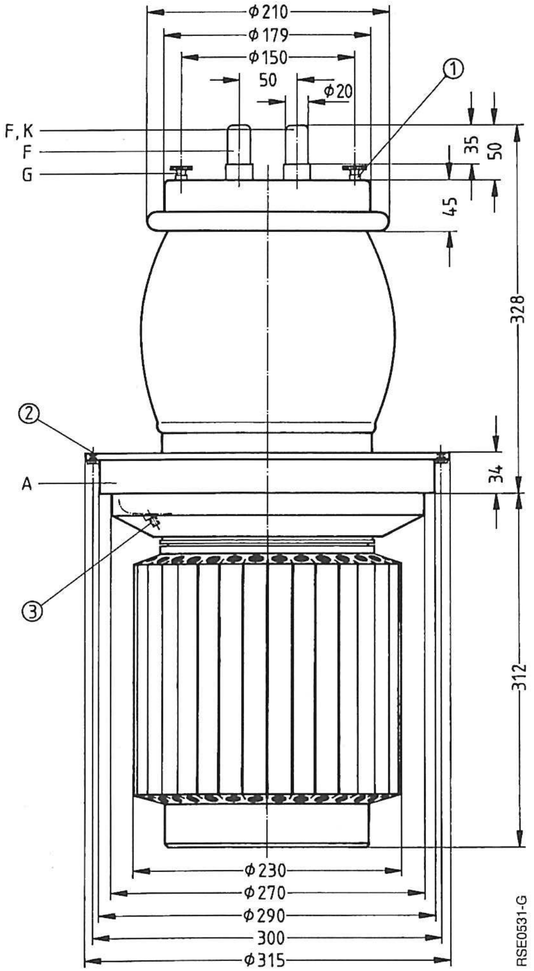
$U_{G1} = f(U_A)$ Parameter = I_A ————————
$U_{G2} = 800$ V Parameter = I_{G2} —·—·—·—·—
Parameter = I_{G1} — — — — — —



VX

Ordering code Q53-X2051

Vapor-cooled triode with coaxial grid lead-through, particularly suitable for modulator operation at low grid current in transmitters up to 600 kW.



Dimensions in mm

① 12 tapholes M5 (12 × 30°)
② Taphole M8 for screw-in handle RöZub41V
③ Taphole M5 for tube fuse RöSich4

Approx. weight 51,5 kg

Heating

Heater voltage	U_F	17	V
Heater current	I_F	≈ 265	A
Heating: direct			
Cathode: thoriated tungsten			

Characteristics

Emission current at $U_A = U_G = 650$ V	I_{em}	160	A
Amplification factor at $U_A = 4$ to 10 kV, $I_A = 5$ A	μ	15	
Transconductance at $U_A = 4$ kV, $I_A = 5$ A	s	105	mA/V

Capacitances

Cathode/grid	c_{kg}	≈ 260	pF
Cathode/anode	c_{ka}	≈ 14	pF [1])
Grid/anode	c_{ga}	≈ 140	pF

Accessories		Ordering code
Mounting instruction	RöMo14	
Mounting instruction	RöMo15	
Cathode connecting strip (2 for each tube)	RöKat41	Q81-X1141
Socket wrench for tube fuse	RöZub10	Q81-X2110
Handle	RöZub41V	Q81-X2141
Tube fuse	RöSich4	Q81-X1404
Pull switch for tube fuse	RöKt11	Q81-X1311
Boiler	RöKüV41	Q81-X1641
Insulating pipe at vapor outlet	RöKüV41Zub3	Q81-X1643
Insulating pipe at water inlet	RöKüV41Zub4	Q81-X1644
Insulator	RöKüV41Zub5K	Q81-X1646
Union at water inlet	RöKüV41Zub7	Q81-X1647
Gasket at vapor outlet	RöKüV41Zub8	Q81-X1648
Water level stabilizer with control electrodes	RöZubV4	Q81-X2105
LL electrolytic target	RöEl23	C65055-A667-A23
Gasket ring for boiler	RöN9374	C65051-A202-C553

1) Measured by means of a 40 cm × 40 cm screening plate in the grid terminal plane.

AF amplifier and modulator, class B operation, 2 tubes in push-pull circuit

Maximum ratings

Anode voltage (dc)	U_A	12	kV
Grid voltage (dc)	U_G	– 1500	V
Cathode current (dc)	I_K	40	A
Peak cathode current	I_{KM}	160	A
Anode dissipation	P_A	180	kW
Grid dissipation	P_G	2,5	kW

Operating characteristics

at modulator operation for

		600 kW carrier power		500 kW carrier power		
Output power	P_{trg}	0	420	0	350	kW
Anode voltage (dc)	U_A	11	11	11	11	kV
Grid voltage (dc)	U_G	– 720	– 720	– 740	– 740	V
Peak control grid voltage (ac) between the 2 tubes	$U_{gg\,m}$	0	2200	0	2100	V
Anode current (dc)	I_A	2 × 3	2 × 31,4	2 × 2	2 × 26	A
Grid current (dc)	I_G	0	2 × 1,1	0	2 × 0,9	A
Peak grid current	I_{GM}	0	2 × 8	0	2 × 7	A
Anode input power	P_{BA}	2 × 33	2 × 345	2 × 22	2 × 286	kW
Drive power	P_1	0	2 × 1050	0	2 × 850	W
Anode dissipation	P_A	2 × 33	2 × 135	2 × 22	2 × 111	kW
Grid dissipation	P_G	0	2 × 280	0	2 × 180	W
Efficiency	η	—	61	—	61	%
Effective load resistance (anode to anode)	R_{AA}	—	350	—	420	Ω

Tube mounting

Axis vertical, anode down.

For connection of the cathode use the terminals listed under “Accessories”.

A number of M5 tapholes is provided at the grid terminal ring for grid connection; the delivery includes knurled head screws for this purpose.

Maximum tube surface temperature

The temperature of the glass and metal parts and of the cathode terminals must not exceed 220 °C at any point.

Vapor cooling

Cooling specifications for maximum anode dissipation	$P_{A\ max}$ = 180 kW
Total power to be dissipated by the cooling system ($P_A + P_G + 0{,}8\ P_F$)	188 kW
Equivalent thermal output	11300 kJ/min (2700 kcal/min)
Flow rate of returning water	
at returning water temperature of 20 °C	approx. 4,4 l/min
at returning water temperature of 90 °C	approx. 5,1 l/min
Volume of generated vapor	
at returning water temperature of 20 °C	approx. 7,3 m^3/min
at returning water temperature of 90 °C	approx. 8,3 m^3/min

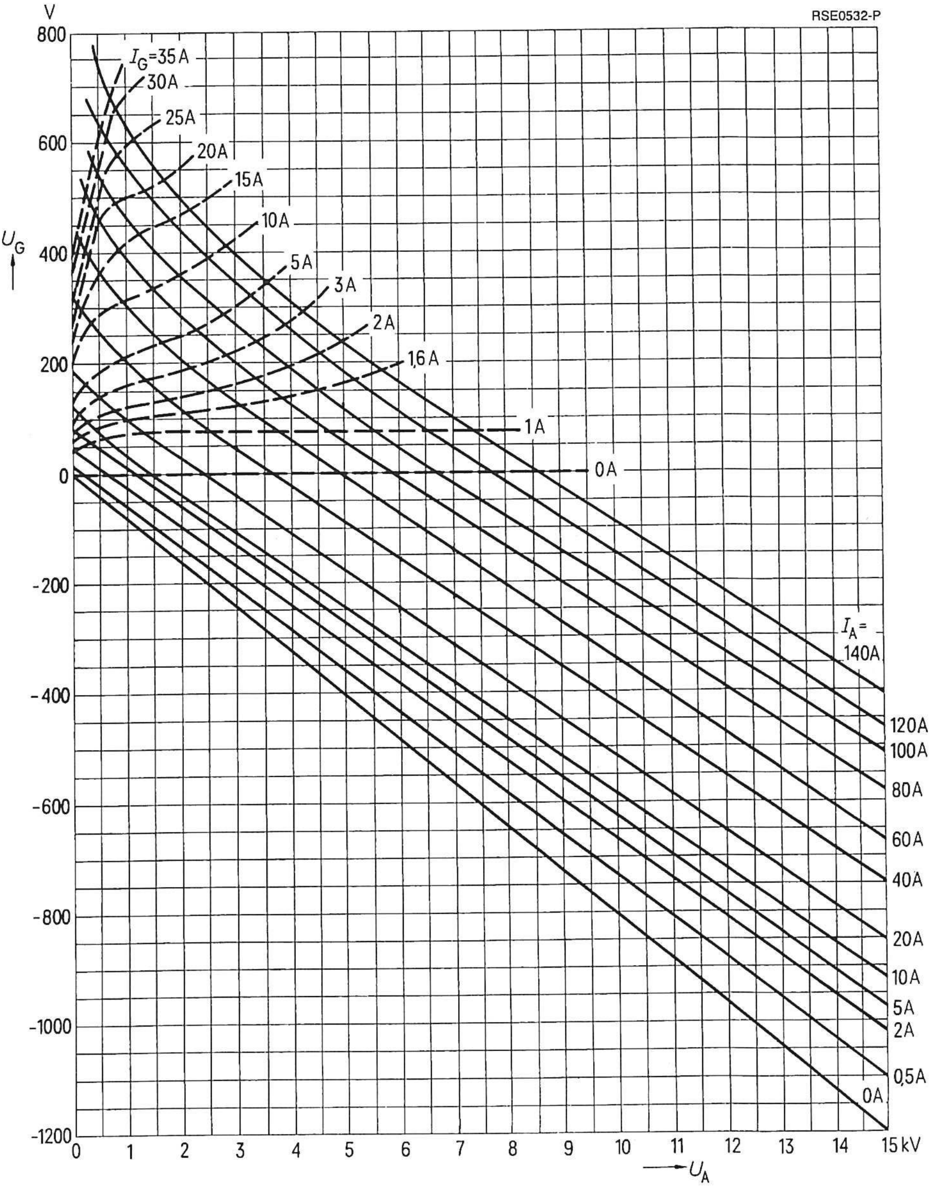
Detailed information on vapor cooling upon request. Please observe instructions on vapor cooling given under “Explanations on Technical Data”.

Safety precautions

The section “Safety precautions” under “Explanations on Technical Data” describes how the tube is to be protected against damage due to electric overload or insufficient cooling. A copper wire with 0,26 mm diameter should be used to test the anode overcurrent trip circuit.

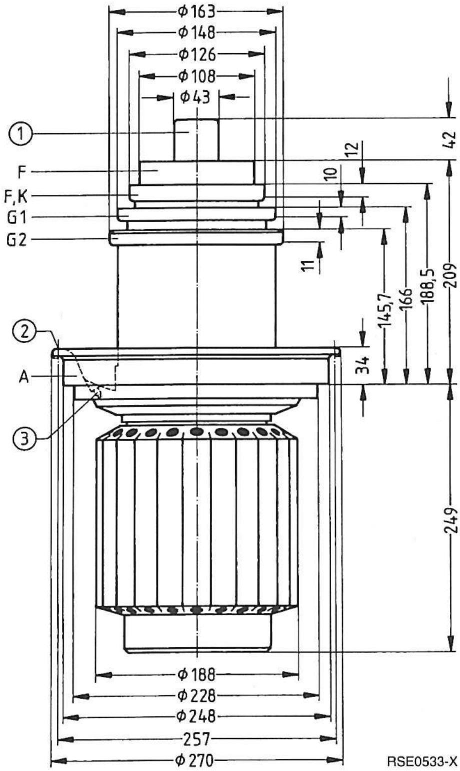
For protection against thermal anode overload the tube fuse RöSich4 is recommended. In conjunction with pull switch RöKt11 it disconnects the voltages at the tube in case of overload (accessories).

$U_G = f(U_A)$ Parameter = I_A ———— Parameter = I_G – – – –



For frequencies up to 130 MHz Ordering code Q53-X2052

Coaxial metal-ceramic tetrode, vapor-cooled, particularly suitable for 100 kW broadcast transmitters up to 30 MHz.



RSE0533-X

Dimensions in mm

① Do not use as terminal
② Taphole M6 for screw-in handle RöZub201K
③ Taphole M5 for tube fuse RöSich4

Approx. weight 30 kg

Heating

Heater voltage	U_F	16	V
Heater current	I_F	≈ 260	A
Heating: direct			
Cathode: thoriated tungsten			

Characteristics

Emission current at $U_A = U_{G2} = U_{G1} = 600$ V	I_{em}	150	A
Amplification factor of screen grid at $U_A = 4$ kV, $U_{G2} = 800$ to 1200 V, $I_A = 5$ A	μ	5,0	
Transconductance at $U_A = 4$ kV, $U_{G2} = 1000$ V, $I_A = 5$ A	s	90	mA/V

Capacitances

Cathode/control grid	c_{kg1}	≈ 160	pF
Cathode/screen grid	c_{kg2}	≈ 20	pF
Cathode/anode	c_{ka}	≈ 0,7	pF [1])
Control grid/screen grid	c_{g1g2}	≈ 240	pF
Control grid/anode	c_{g1a}	≈ 5,0	pF [1])
Screen grid/anode	c_{g2a}	≈ 80	pF

Accessories

Accessories		Ordering code
Mounting instruction	RöMo252	
Internal cathode terminal	RöKat3150	Q81-X1104
External cathode terminal	RöKat3151	Q81-X1105
Cathode connecting strip (2 for each tube)	RöKat363	Q81-X1174
Control grid terminal	RöGit252	Q81-X4
Screen grid terminal	RöGit253	Q81-X998
SW header socket	RöKpf254K	Q81-X1801
Socket wrench for tube fuse	RöZub10	Q81-X2110
Handle	RöZub201K	Q81-X2151
Tube fuse	RöSich4	Q81-X1404
Pull switch for tube fuse	RöKt11	Q81-X1311
Boiler	RöKüV201	Q81-X1671
Union at water inlet	RöKüV41Zub7	Q81-X1647
Insulating pipe at vapor outlet	RöKüV201Zub3	Q81-X1673
Insulating pipe at water inlet	RöKüV201Zub4	Q81-X1674
Insulator	RöKüV201Zub5K	Q81-X1675
Gasket at vapor outlet	RöKüV201Zub8	Q81-X1678
LL electrolytic target	RöEl23	C65055-A667-A23
Gasket for boiler	RöN9355	C65051-A201-C531

1) Measured by means of a 50 cm diameter screening plate in the screen grid terminal plane.

Anode and screen-grid modulation, class C operation, grounded cathode circuit

Maximum ratings

Frequency	f	30	MHz
Anode voltage (dc)	U_A	12	kV
Screen grid voltage (dc)	U_{G2}	900	V
Control grid voltage (dc)	U_{G1}	– 800	V
Cathode current (dc)	I_K	25	A
Peak cathode current	$I_{K\,M}$	150	A
Anode dissipation	P_A	120	kW
Screen grid dissipation	P_{G2}	2500	W
Control grid dissipation	P_{G1}	800	W

Operating characteristics

Frequency	f	≤ 30	≤ 30	MHz
Carrier power	P_{trg}	110	110	kW 1)
Anode voltage (dc)	U_A	11	10	kV
Screen grid voltage (dc)	U_{G2}	800	800	V
Control grid bias (dc), fixed	$U_{G1\,fix}$	– 250	– 250	V
Control grid resistance	R_{G1}	440	350	Ω
Peak control grid voltage (ac)	$U_{g1\,m}$	820	850	V
Anode current (dc)	I_A	12,4	14	A
Screen grid current (dc)	I_{G2}	1,6	2,0	A
Control grid current (dc)	I_{G1}	0,8	1,0	A
Anode input power	$P_{B\,A}$	136	140	kW
Drive power	P_1	590	760	W 1)
Anode dissipation	P_A	26	30	kW 2)
Screen grid dissipation	P_{G2}	1280	1600	W
Control grid dissipation	P_{G1}	110	160	W
Efficiency	η	81	79	%
Anode load resistance	R_A	470	380	Ω
Modulation factor	m	100	100	%
Peak screen grid voltage (ac)	$U_{g2\,m}$	700	700	V 3)
Modulation power	P_{mod}	68	70	kW
Control grid current (dc)	I_{G1}	1,0	1,3	A 4)
Drive power	P_1	800	1000	W 1)4)
Anode dissipation at modulation	$P_{A\,mod}$	45	50	kW 5)
Screen grid dissipation at modulation	$P_{G2\,mod}$	1600	2000	W 4)

1) Circuit losses are not included.
2) Even during modulation the indicated maximum ratings must not be exceeded. It has to be observed that during 100 % modulation the anode dissipation increases to about 1,5 times the power dissipation stated for the carrier value.
3) Modulation of screen grid via separate transformer winding or choke in the screen grid line.
4) Maximum values at $U_A = 0$ V.
5) Average value at m = 100 %.

Tube mounting

Axis vertical, anode down.

Maximum tube surface temperature

The temperature of the metal-ceramic seals must not exceed 220 °C at any point. Sufficient cooling of the terminal side has to be provided by means of an air flow of approximately 2 to 3 m^3/min.

Vapor cooling

Cooling specifications for maximum anode dissipation	$P_{A\,max}$ = 120 kW
Total power to be dissipated by the cooling system ($P_A + P_G + 0{,}8\ P_F$)	125,5 kW
Equivalent thermal output	7520 kJ/min (2700 kcal/min)
Flow rate of returning water	
at returning water temperature of 20 °C	approx. 2,8 l/min
at returning water temperature of 90 °C	approx. 3,3 l/min
Volume of generated vapor	
at returning water temperature of 20 °C	approx. 4,9 m^3/min
at returning water temperature of 90 °C	approx. 5,6 m^3/min

Detailed information on vapor cooling upon request. Please observe instructions on vapor cooling given under “Explanations on Technical Data”.

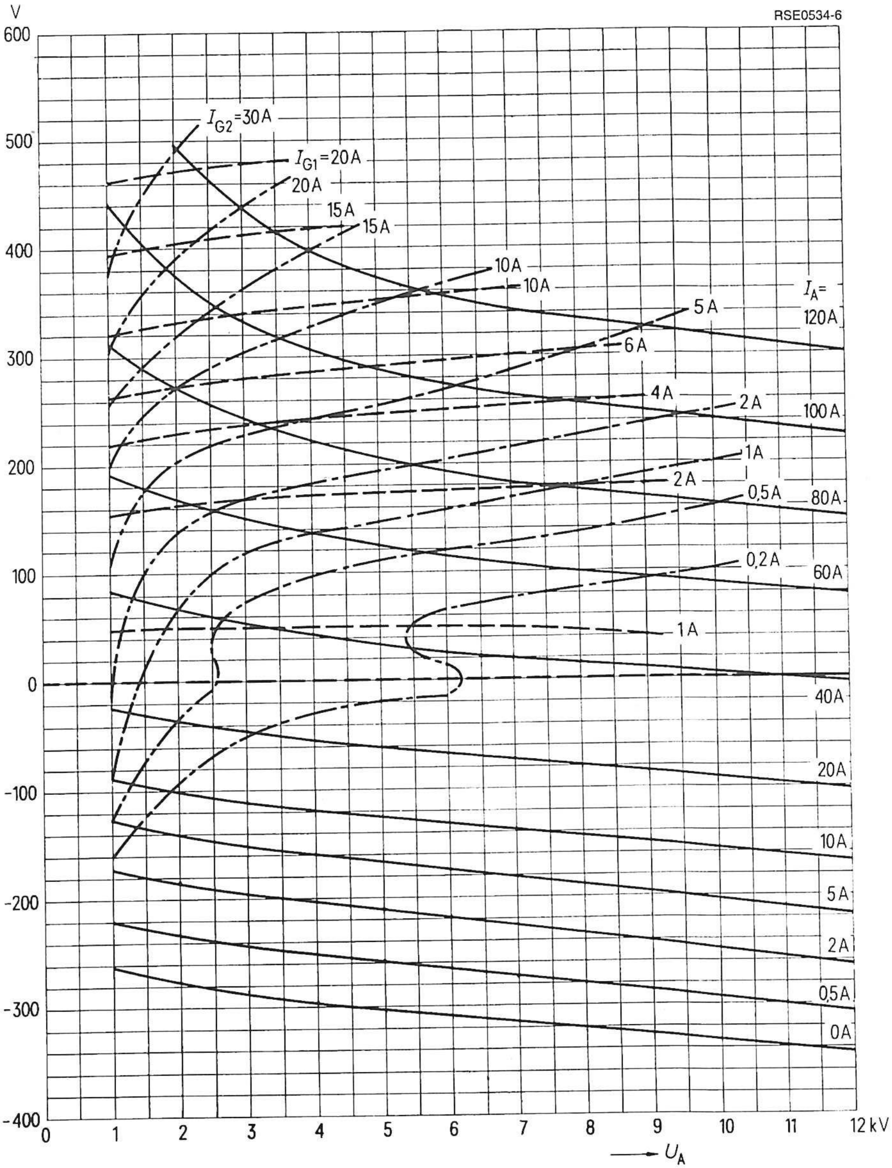
Safety precautions

The section “Safety precautions” under “Explanations on Technical Data” describes how the tube is to be protected against damage due to electric overload or insufficient cooling. A copper wire with 0,30 mm diameter should be used to test the anode overcurrent trip circuit.

The tube fuse RöSich4 is recommended for protecting the vapor-cooled version RS 2052 CV against thermal anode overload. In conjunction with pull switch RöKt11 it disconnects the voltages at the tube in case of overload.

$U_{G1} = f(U_A)$
$U_{G2} = 1000$ V

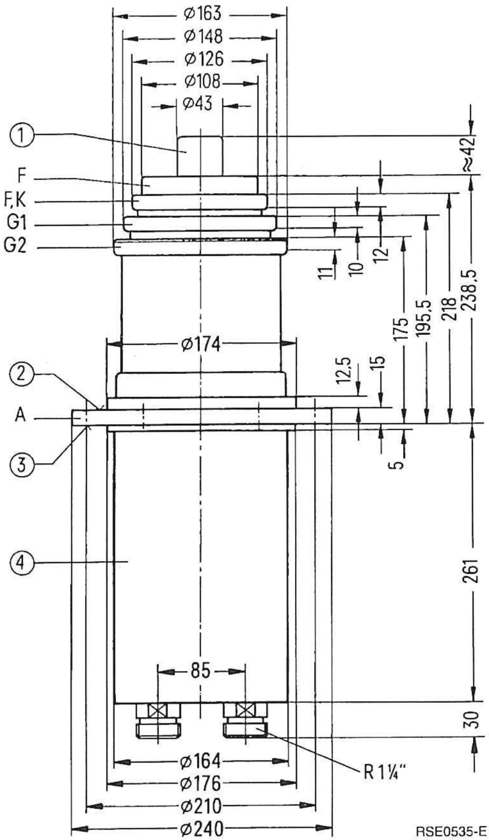
Parameter = I_A ————
Parameter = I_{G2} —·—·—·—
Parameter = I_{G1} — — — —



For frequencies up to 150 MHz

Ordering code Q53-X2054

Coaxial metal-ceramic tetrode, vapor-condensation-cooled, particularly suitable for 100 kW broadcast transmitters up to 30 MHz, for grid-current free operated modulators in transmitters up to 300 kW, and for use as switching tube in PDM transmitters up to 100 kW, as well as for RF amplifiers up to 150 kW/up to 150 MHz.



RSE0535-E

Dimensions in mm

① Do not use as terminal
② Taphole M8 for handle RöZub252
③ 6 fixing holes, 13 mm dia. (6 × 60°)
④ Do not use boiler as anode terminal

Approx. weight 24 kg

Heating

Heater voltage	U_F	15	V
Heater current	I_F	≈ 180	A
Heating: direct			
Cathode: thoriated tungsten			

Characteristics

Emission current at $U_A = U_{G2} = U_{G1} = 500$ V	I_{em}	150	A
Amplification factor of screen grid at $U_A = 4$ kV, $U_{G2} = 800$ to 1200 V, $I_A = 5$ A	μ	4,5	
Transconductance at $U_A = 4$ kV, $U_{G2} = 1000$ V, $I_A = 5$ A	s	90	mA/V

Capacitances

Cathode/control grid	c_{kg1}	≈ 170	pF
Cathode/screen grid	c_{kg2}	≈ 16	pF
Cathode/anode	c_{ka}	≈ 0,5	pF [1])
Control grid/screen grid	c_{g1g2}	≈ 300	pF
Control grid/anode	c_{g1a}	≈ 3,0	pF [1])
Screen grid/anode	c_{g2a}	≈ 70	pF

Accessories

		Ordering code
Cathode connecting strip (2 for each tube)	RöKat363	Q81-X1174
Short-wave header socket	RöKpf254K	Q81-X1801
Medium-wave header socket	RöKpf254M	Q81-X1857
Handle	RöZub252	Q81-X1705
Insulating hose	RöZub254SK	Q81-X2117
LL electrolytic target for $^3/_4$″ hose	RöEl8	Q81-X513

1) Measured by means of a 60 cm diameter screening plate in the screen grid terminal plane.

RF amplifier,
class B operation, grounded control-grid screen-grid circuit

Maximum ratings

Frequency	f	110	MHz
Anode voltage (dc)	U_A	24	kV
Screen grid voltage (dc)	U_{G2}	1600	V
Control grid voltage (dc)	U_{G1}	– 1000	V
Cathode current (dc)	I_K	30	A
Peak cathode current	$I_{K\,M}$	150	A
Anode dissipation	P_A	120	kW [3]
Screen grid dissipation	P_{G2}	3000	W
Control grid dissipation	P_{G1}	1000	W

Operating characteristics

Frequency	f	50	100	MHz
Output power	P_2	180 + 10,6 [2]	100	kW [1]
Anode voltage (dc)	U_A	10	11	kV
Screen grid voltage (dc)	U_{G2}	1200	800	V
Control grid voltage (dc)	U_{G1}	– 400	– 300	V
Peak control grid voltage (ac)	$U_{g1\,m}$	500	350	V
Anode current (dc)	I_A	26,8	13,6	A
Screen grid current (dc)	I_{G2}	0,7	0,3	A
Control grid current (dc)	I_{G1}	0,8	0,25	A
Anode input power	$P_{B\,A}$	268	150	kW
Drive power	P_1	0,4 + 10,6 [2]	4,0	kW [1]
Anode dissipation	P_A	88	54	kW
Screen grid dissipation	P_{G2}	900	240	W
Control grid dissipation	P_{G1}	80	8	W
Efficiency	η	67	64	%
Anode load resistance	R_A	200	500	Ω

1) Circuit losses are not included.
2) Power transition of grounded control-grid screen-grid circuit.
3) Higher max. ratings may be released upon request.

Anode and screen-grid modulation, class C operation, grounded cathode circuit

Maximum ratings

Frequency	f	30	MHz
Anode voltage (dc)	U_A	15	kV
Screen grid voltage (dc)	U_{G2}	1500	V
Control grid voltage (dc)	U_{G1}	– 1000	V
Cathode current (dc)	I_K	20	A
Peak cathode current	$I_{K\,M}$	150	A
Anode dissipation	P_A	120	kW 5)
Screen grid dissipation	P_{G2}	3000	W
Control grid dissipation	P_{G1}	1000	W

Operating characteristics

Frequency	f	≤ 30	MHz
Carrier power	P_{trg}	105	kW 1)
Anode voltage (dc)	U_A	11,2	kV
Screen grid voltage (dc)	U_{G2}	800	V
Control grid bias (dc), fixed	$U_{G1\,fix}$	– 250	V
Control grid resistance	R_{G1}	360	Ω
Peak control grid voltage (ac)	$U_{g1\,m}$	770	V
Anode current (dc)	I_A	10,8	A
Screen grid current (dc)	I_{G2}	1,0	A
Control grid current (dc)	I_{G1}	1,1	A
Anode input power	$P_{B\,A}$	121	kW
Drive power	P_1	800	W 1)
Anode dissipation	P_A	16	kW 2)
Screen grid dissipation	P_{G2}	800	W
Control grid dissipation	P_{G1}	90	W
Efficiency	η	87	% 3)
Anode load resistance	R_A	520	Ω
Modulation factor	m	100	%
Peak screen grid voltage (ac)	$U_{g2\,m}$	550	V
Anode input power during modulation	$P_{B\,A\,mod}$	182	kW
Control grid current (dc)	I_{G1}	1,3	A 4)
Drive power	P_1	1000	W 1)4)
Anode dissipation at modulation	$P_{A\,mod}$	24	kW

1) Circuit losses are not included.
2) Even during modulation the indicated maximum ratings must not be exceeded. It has to be observed that during 100 % modulation the anode dissipation increases to about 1,5 times the power dissipation stated for the carrier value.
3) Without 3-f circuit.
4) Maximum values at U_A = 0 V.
5) Higher max. ratings may be released upon request.

PDM switching tube
for 100 kW carrier power of final stage

Maximum ratings

Anode input voltage (dc)	U_{BA}	30	kV
Screen grid voltage (dc)	U_{G2}	1500	V
Control grid voltage (dc)	U_{G1}	– 1000	V
Cathode current (dc)	I_K	20	A
Peak cathode current	I_{KM}	150	A
Anode dissipation	P_A	120	kW
Screen grid dissipation	P_{G2}	3000	W
Control grid dissipation	P_{G1}	1000	W

Operating characteristics

Modulation factor of the RF final stage	m	0	100	%
Switching frequency	f	54	54	kHz
Output power	P_2	121	181,5	kW
Anode input voltage (dc)	U_{BA}	23,5	23,5	kV [1]
Screen grid voltage (dc)	U_{G2}	600	600	V
Control grid voltage (dc)	U_{G1}	– 750	– 750	V
Peak control grid voltage (ac)	U_{g1m}	790	790	V
Anode current (dc)	I_A	5,25	7,9	A
Screen grid current (dc)	I_{G2}	2,7	2,0	A
Control grid current (dc)	I_{G1}	0,85	0,85	A
Anode input power	P_{BA}	123,5	185,5	kW
Drive power	P_1	1400	1400	W [2]
Anode dissipation	P_A	2,5	4,0	kW
Screen grid dissipation	P_{G2}	1700	1200	W
Control grid dissipation	P_{G1}	35	35	W
Efficiency	η	98	98	% [2]
Effective load resistance (RF final stage)	R_A	1040	1040	Ω

1) Output voltage of RF rectifier.
2) Losses in other components of the pulse-duration modulator are not included.

AF amplifier and modulator, class B operation, 2 tubes in push-pull circuit, $I_{G1} = 0$

Maximum ratings

Anode voltage (dc)	U_A	15	kV
Screen grid voltage (dc)	U_{G2}	1500	V
Control grid voltage (dc)	U_{G1}	– 1000	V
Cathode current (dc)	I_K	20	A
Peak cathode current	I_{KM}	150	A
Anode dissipation	P_A	120	kW [1]
Screen grid dissipation	P_{G2}	3000	W
Control grid dissipation	P_{G1}	1000	W

Operating characteristics

at modulator operation for

		300 kW carrier power		
Output power	P_2	0	186	kW
Anode voltage (dc)	U_A	12	12	kV
Screen grid voltage (dc)	U_{G2}	1200	1200	V
Control grid voltage (dc)	U_{G1}	– 390	– 390	V
Peak control grid voltage (ac) between the 2 tubes	$U_{gg\,m}$	0	720	V
Anode current (dc)	I_A	$2 \times 0{,}7$	$2 \times 11{,}6$	A
Screen grid current (dc)	I_{G2}	0	$2 \times 0{,}5$	A
Anode input power	P_{BA}	$2 \times 8{,}4$	$2 \times 139{,}2$	kW
Anode dissipation	P_A	$2 \times 8{,}4$	$2 \times 46{,}2$	kW
Screen grid dissipation	P_{G2}	0	2×600	W
Efficiency	η	—	66,8	%
Effective load resistance (anode to anode)	R_{AA}	—	1100	Ω

1) Higher max. ratings may be released upon request.

Tube mounting

Axis vertical, anode up or down.

For connection of the tube use the terminals listed under “Accessories”.

Maximum tube surface temperature

The maximum temperature of the tube surface must not exceed 220 °C. The maximum permissible temperature difference at the tube circumference is 50 °C. The temperature gradient at the tube must not exceed 25 °C/cm. The surface temperature will remain below the maximum values if an air stream of approx. 2 to 3 m^3/min is directed onto the tube terminals.

Vapor condensation cooling

The cooling water diagram gives the minimum water flow rate (distilled or deionized water) for maximum anode dissipation, as well as pressure drop and water outlet temperature at 65 °C water inlet temperature. The diagram applies to a hermetically sealed cooling system with 1,5 bar overpressure at the cooling water outlet with a maximum permissible outlet temperature of 100 °C.

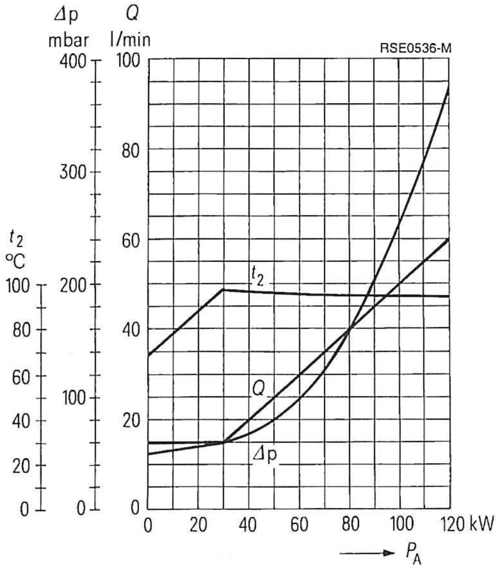
Operation with open cooling cycle (without overpressure) is possible if the maximum outlet temperature remains below 65 °C (sea level, air pressure ≈ 1 bar) with lower inlet temperature and, if required, increased water flow rate.

For more information on vapor condensation cooling refer to “Explanations on Technical Data”.

Safety precautions

The section “Safety precautions” under “Explanations on Technical Data” describes how the tube is to be protected against damage due to electric overload or insufficient cooling. A copper wire with 0,30 mm diameter should be used to test the anode overcurrent trip circuit.

Cooling water diagram

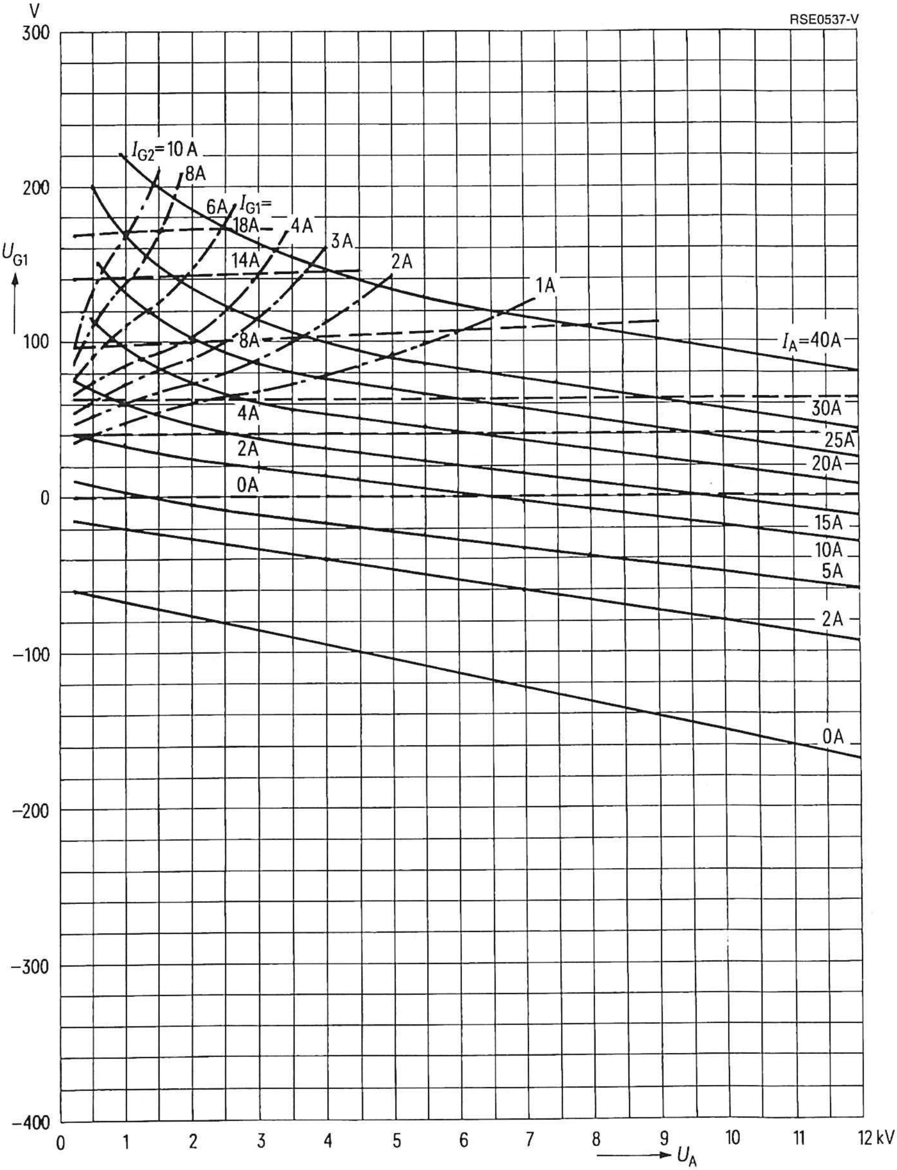


Hermetically sealed cooling system with destilled water.

Overpressure = 1,5 bar

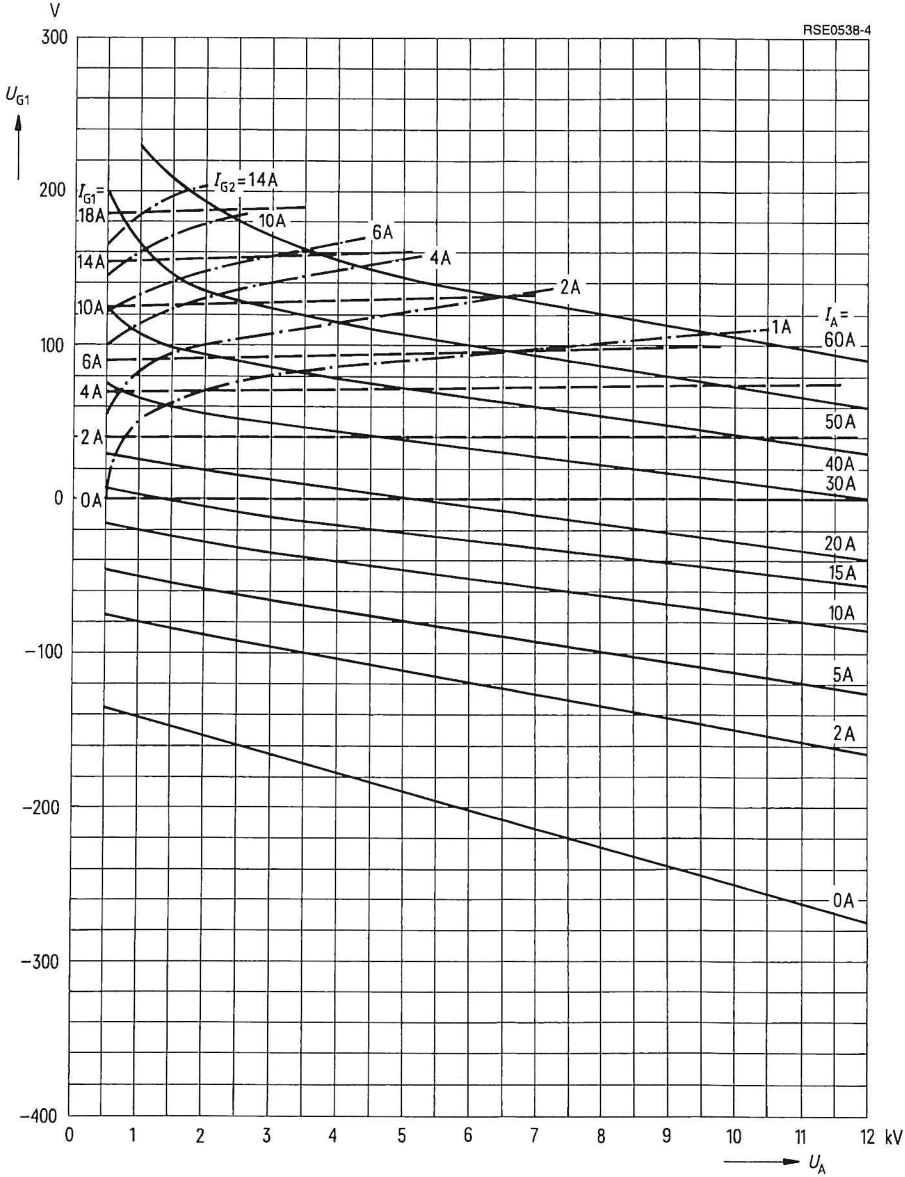
t_1 = 60 °C

$U_{G1} = f(U_A)$ Parameter = I_A ————
$U_{G2} = 200$ V Parameter = I_{G2} —·—·—
Parameter = I_{G1} — — — —



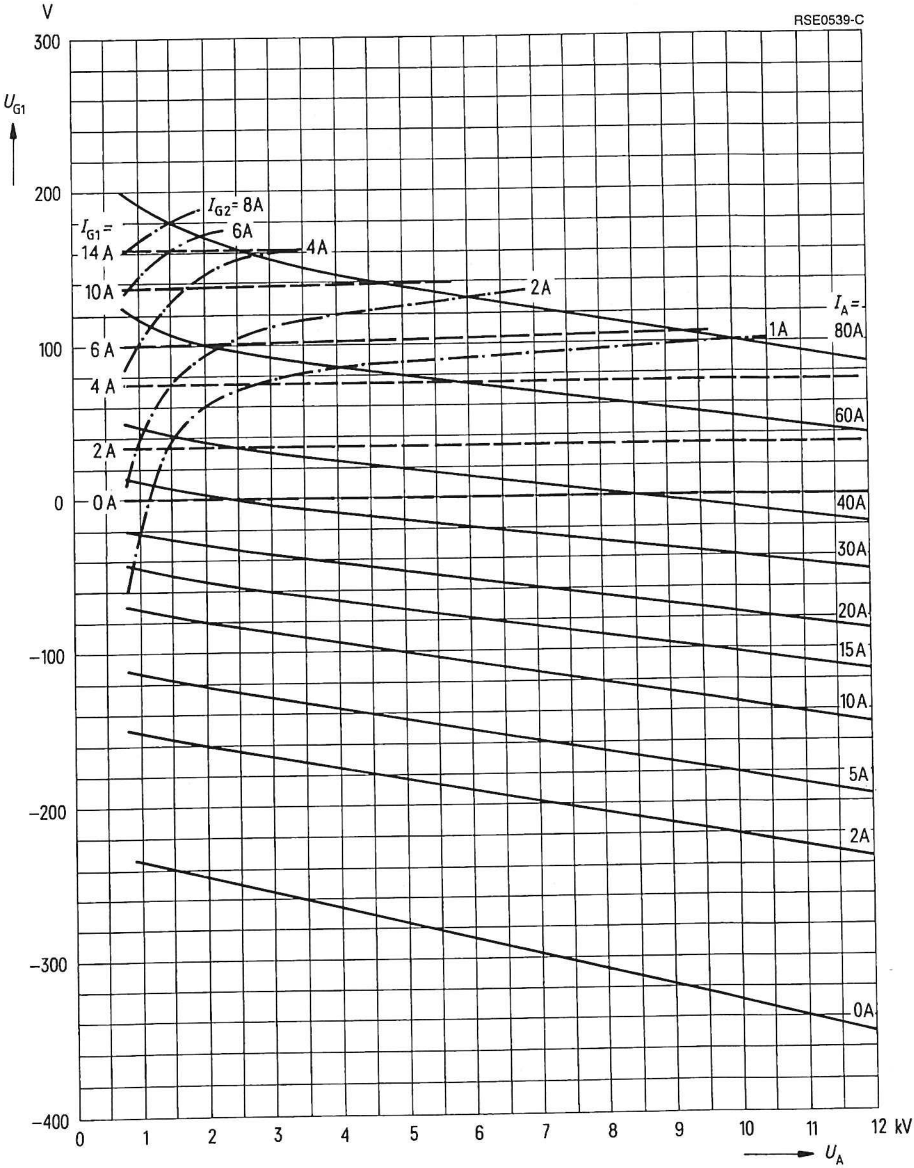
$U_{G1} = f(U_A)$
$U_{G2} = 500$ V

Parameter = I_A ————
Parameter = I_{G2} —·—·—·—
Parameter = I_{G1} — — — —



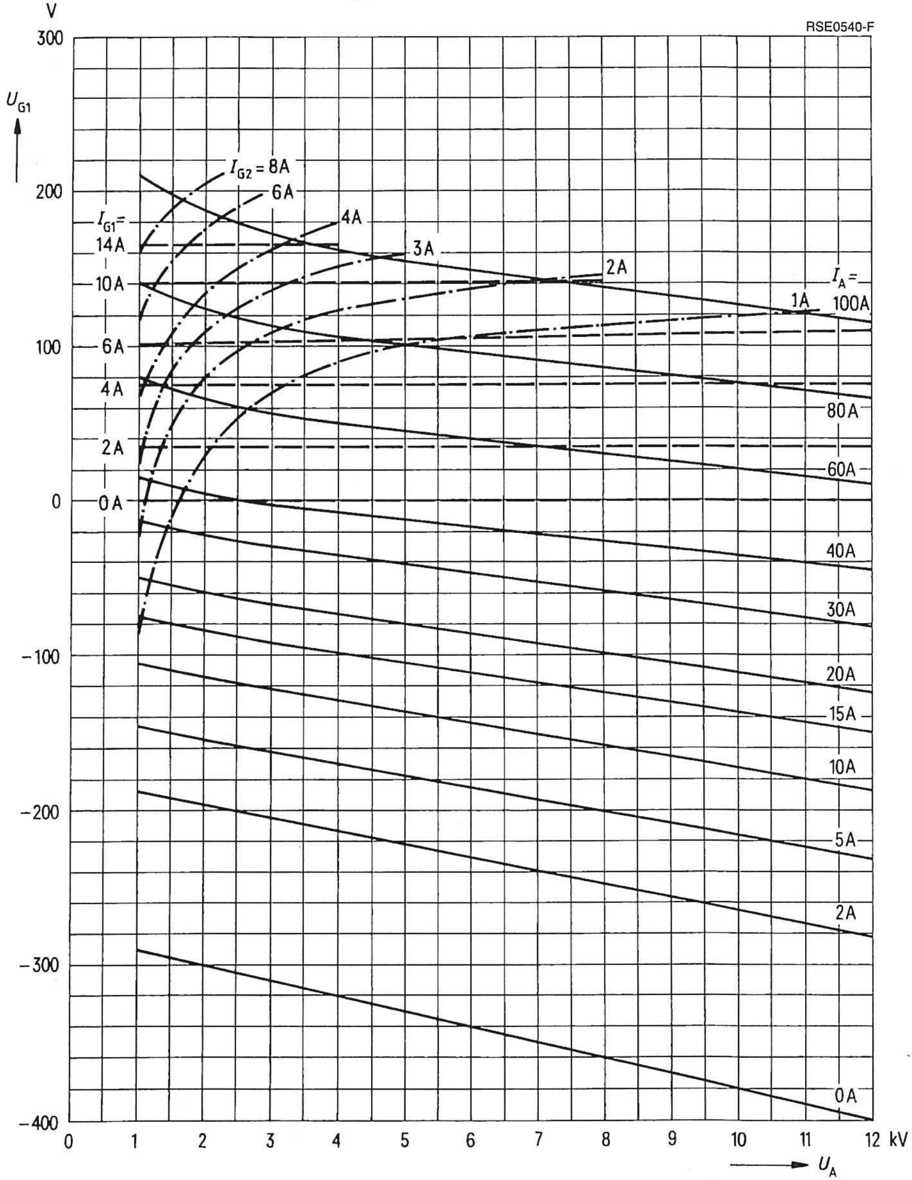
$U_{G1} = f(U_A)$
$U_{G2} = 800$ V

Parameter = I_A ————
Parameter = I_{G2} —·—·—
Parameter = I_{G1} — — — —



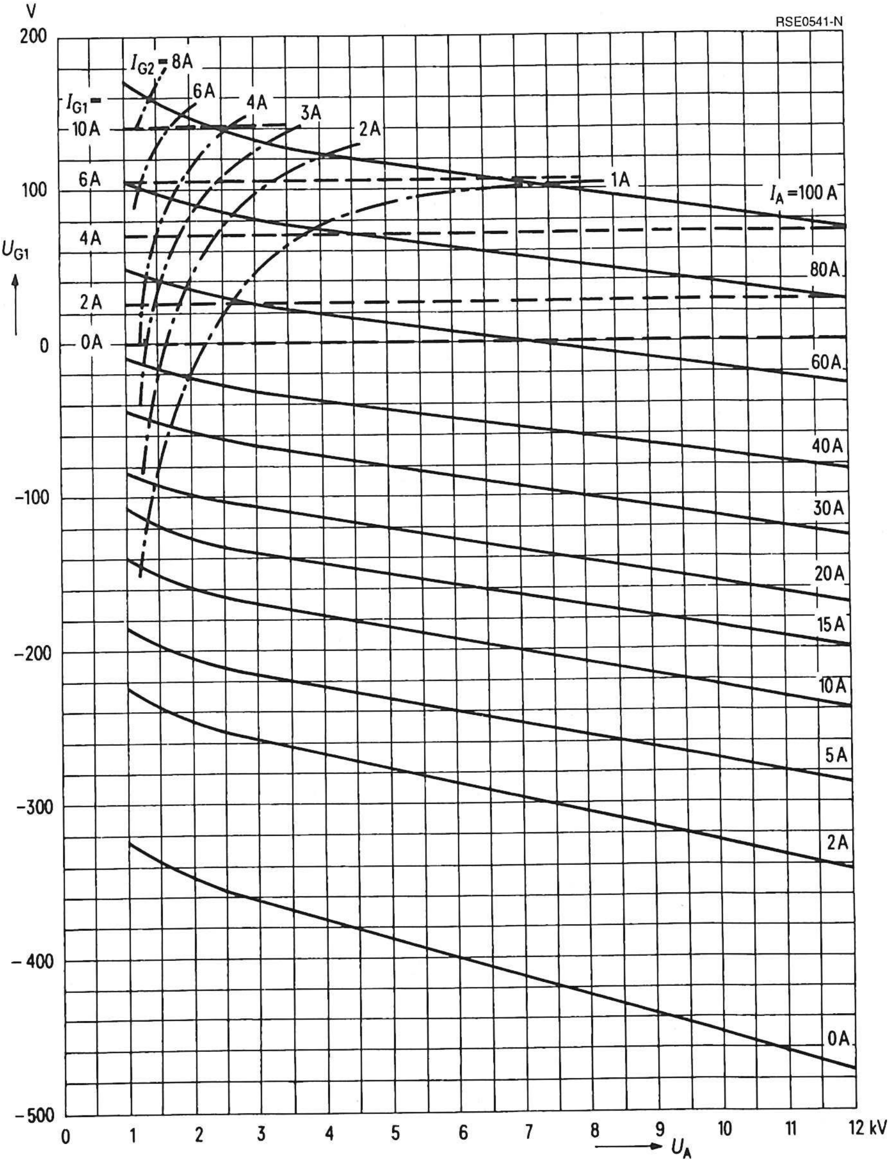
$U_{G1} = f(U_A)$
$U_{G2} = 1000$ V

Parameter = I_A ————————
Parameter = I_{G2} —·—·—·—·—
Parameter = I_{G1} — — — — — —

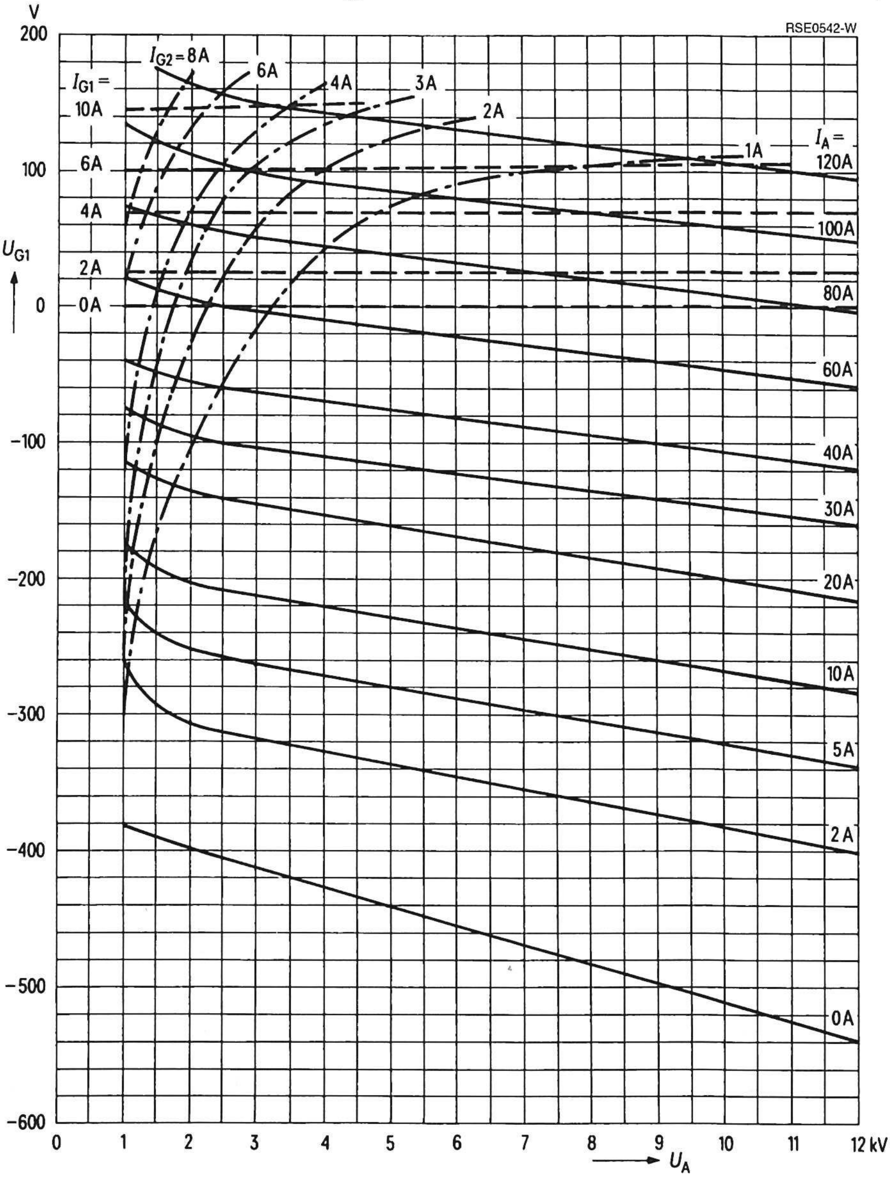


$U_{G1} = f(U_A)$
$U_{G2} = 1200$ V

Parameter = I_A ————
Parameter = I_{G2} —·—·—
Parameter = I_{G1} — — —

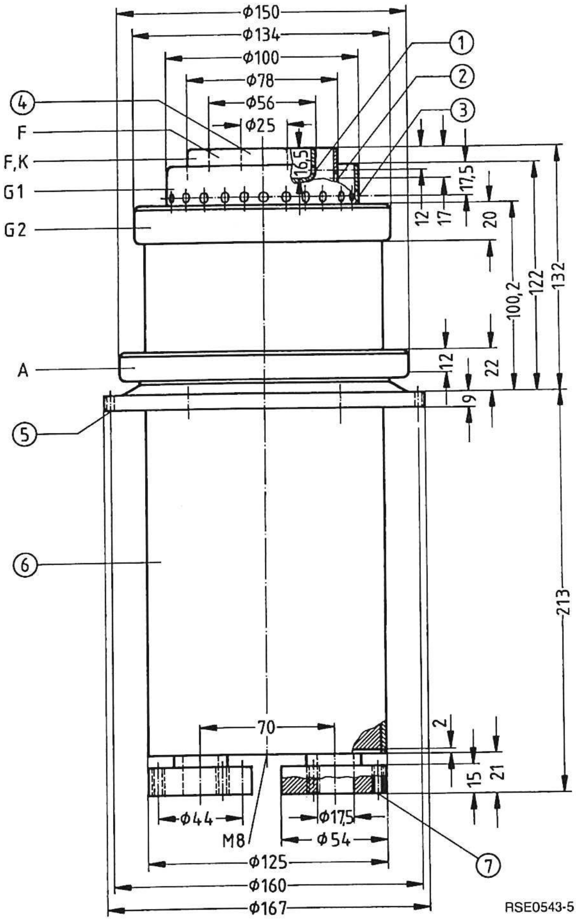


$U_{G1} = f(U_A)$ Parameter = I_A ———————
U_{G2} = 1400 V Parameter = I_{G2} —·—·—·—
Parameter = I_{G1} — — — — —



Ordering code Q52-X2058

Coaxial metal-ceramic tetrode, water-cooled with integrated cooling jacket, particularly suitable for RF amplifiers up to 220 MHz.



Dimensions in mm

① 24 ventilation holes 3 mm dia. (24 × 15°)
② 24 ventilation holes 4 mm dia. (24 × 15°)
③ 24 ventilation holes 5 mm dia. (24 × 15°)
④ Do not use as terminal
⑤ 6 fixing holes 4,5 mm dia. (6 × 60°)
⑥ Do not use cooling jacket as anode terminal
⑦ 3 tapholes M6 (3 × 120°)

Approx. weight 11,5 kg

Heating

Heater voltage	U_F	11	V
Heater current	I_F	≈ 185	A
Heating: direct			
Cathode: thoriated tungsten			

Characteristics

Emission current at $U_A = U_{G2} = U_{G1} = 550$ V	I_{em}	100	A
Amplification factor of screen grid at $U_A = 3$ kV, $U_{G2} = 800$ to 1200V, $I_A = 5$ A	μ_{g2g1}	6,0	
Transconductance at $U_A = 3$ kV, $U_{G2} = 1200$ V, $I_A = 3$ A	S	75	mA/V

Capacitances

Cathode/control grid	c_{kg1}	≈ 140	pF
Cathode/screen grid	c_{kg2}	≈ 11	pF
Cathode/anode	c_{ka}	≈ 0,3	pF 1)
Control grid/screen grid	c_{g1g2}	≈ 180	pF
Control grid/anode	c_{g1a}	≈ 1,8	pF 1)
Screen grid/anode	c_{g2a}	≈ 40	pF

Accessories

Upon request

1) Measured by means of a 40 cm diameter screening plate in the screen grid terminal plane.

RF amplifier, class B operation, grounded control-grid screen-grid circuit

Maximum ratings

Frequency	f	220	MHz
Anode voltage (dc)	U_A	12	kV
Screen grid voltage (dc)	U_{G2}	1000	V
Control grid voltage (dc)	U_{G1}	– 350	V
Cathode current (dc)	I_K	35	A
Peak cathode current	$I_{K\,M}$	100	A
Anode dissipation	P_A	90	kW
Screen grid dissipation	P_{G2}	650	W
Control grid dissipation	P_{G1}	160	W

Operating characteristics

Frequency	f	200	MHz
Output power	P_2	64 + 2,3 [2])	kW [1])
Anode voltage (dc)	U_A	10	kV
Screen grid voltage (dc)	U_{G2}	900	V
Control grid voltage (dc)	U_{G1}	– 250	V
Peak control grid voltage (ac)	$U_{g1\,m}$	320	V
Anode current (dc)	I_A	8,8	A
Screen grid current (dc)	I_{G2}	0,25	A
Control grid current (dc)	I_{G1}	0,3	A
Anode input power	$P_{B\,A}$	88	kW
Drive power	P_1	90 + 2300 [2])	W [1])
Anode dissipation	P_A	22	kW
Screen grid dissipation	P_{G2}	225	W
Control grid dissipation	P_{G1}	15	W
Efficiency	η	72	%
Anode load resistance	R_A	550	Ω

1) Circuit losses are not included.
2) Power transition of grounded control-grid screen-grid circuit.

RF amplifier,
class B operation, grounded control-grid screen-grid circuit

Maximum ratings

Frequency	f	220	220	MHz
Anode voltage (dc)	U_A	15	12	kV
Screen grid voltage (dc)	U_{G2}	1500	1000	V
Control grid voltage (dc)	U_{G1}	– 350	– 350	V
Cathode current (dc)	I_K	35	35	A
Peak cathode current	I_{KM}	100	100	A
Anode dissipation	P_A	90	90	kW
Screen grid dissipation	P_{G2}	400	650	W 5)
Control grid dissipation	P_{G1}	160	160	W

Operating characteristics

Frequency	f	200	200	MHz
Pulse duration	t_p	$0{,}25 \times 10^{-3}$	1,0	s
Pulse separation	t_0	1,0	3,0	s
Pulse output power	P_{2p}	150 + 4,6 2)	116 + 4 2)	kW 1)
Anode voltage (dc)	U_A	13,5	10	kV
Screen grid voltage (dc)	U_{G2}	1100	900	V
Control grid voltage (dc)	U_{G1}	– 250 3)	– 200 4)	V
Peak pulse control grid voltage (ac)	U_{g1mp}	370	325	V
Pulse anode current (dc)	I_{Ap}	17,6	19	A
Pulse screen grid current (dc)	I_{G2p}	1	0,6	A
Pulse control grid current (dc)	I_{G1p}	1,5	0,9	A
Pulse anode input power	P_{BAp}	238	190	kW
Pulse drive power	P_{1p}	0,5 + 4,6 2)	0,3 + 4 2)	kW 1)
Pulse anode dissipation	P_{Ap}	88	74	kW
Mean anode dissipation	P_A	0,02	19	kW
Pulse screen grid dissipation	P_{G2p}	1400	700	W
Pulse control grid dissipation	P_{G1p}	140	90	W
Pulse efficiency	η	63	61	%
Anode load resistance	R_A	480	335	Ω

1) Circuit losses are not included.
2) Power transition of grounded control-grid screen-grid circuit.
3) For zero signal dc anode current $I_{A0} = 1$ A.
4) For zero signal dc anode current $I_{A0} = 0{,}5$ A.
5) Mean value, permissible at the pulse frequency stated in the corresponding column.

Tube mounting

Axis vertical, anode up or down.

For connection of the tube use either header connectors or individual connectors (upon request).

Maximum tube surtace temperature

The temperature of the metal-ceramic seals must not exceed 220 °C at any point. If the header sockets with air connecting piece intended for RF operation are used, sufficient cooling is ensured by a minimum air flow of 0,6 m^3/min with a pressure drop of approximately 1,5 mbar. If individual connectors are used, a free air stream of 2 m^3/min has to be directed onto the terminal side.

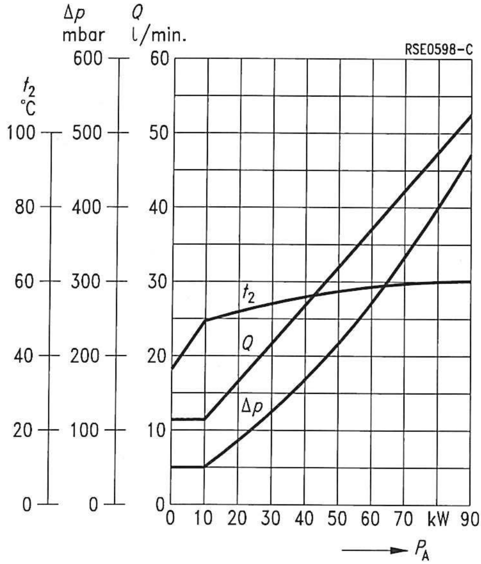
Water cooling

The cooling water diagram is valid for 35 °C water inlet temperature. The maximum permissible pressure of the cooling water, measured at the water inlet, is 6 bar. Please observe instructions on water cooling given under “Explanations on Technical Data”.

Safety precautions

The section “Safety precautions" under “Explanations on Technical Data" describes how the tube is to be protected against damage due to electric overload or insuflicient cooling. A copper wire with 0,25 mm diameter should be used to test the anode overcurrent trip circuit.

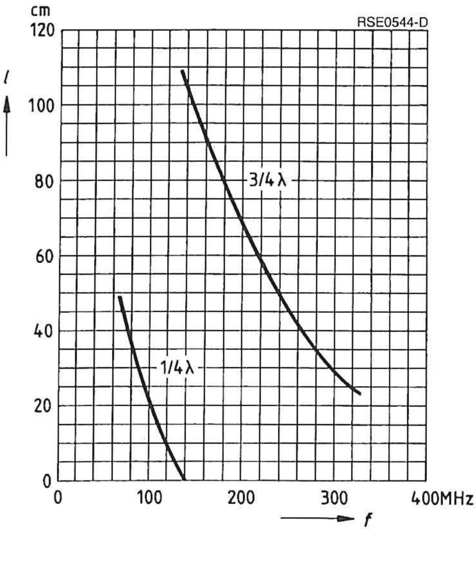
Cooling water diagram

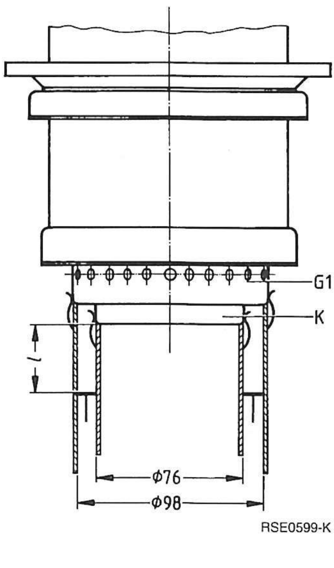


$t_1 = 35$ °C

Tuning curves for coaxial circuits

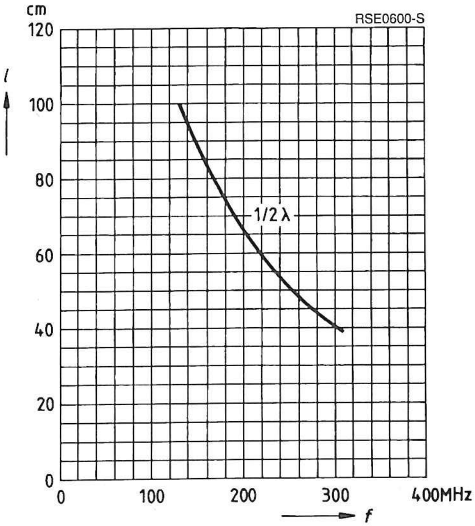
Control-grid cathode circuit

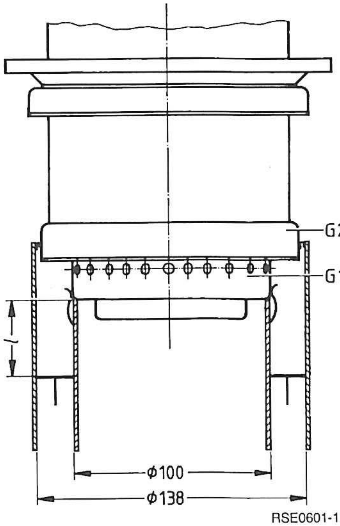




Tuning curves for coaxial circuits

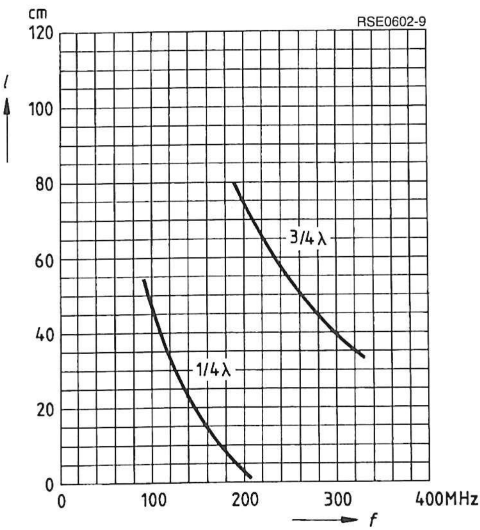
Screen-grid control-grid circuit

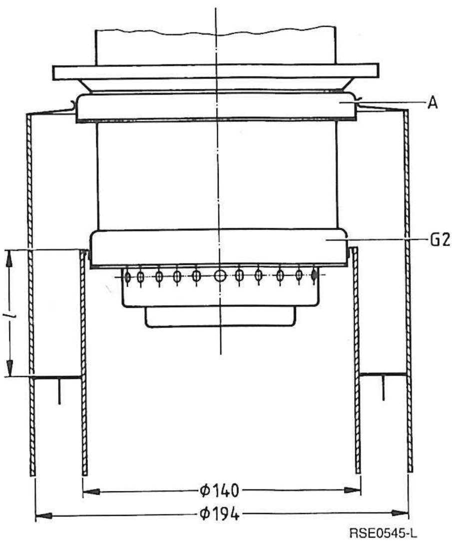




Tuning curves for coaxial circuits

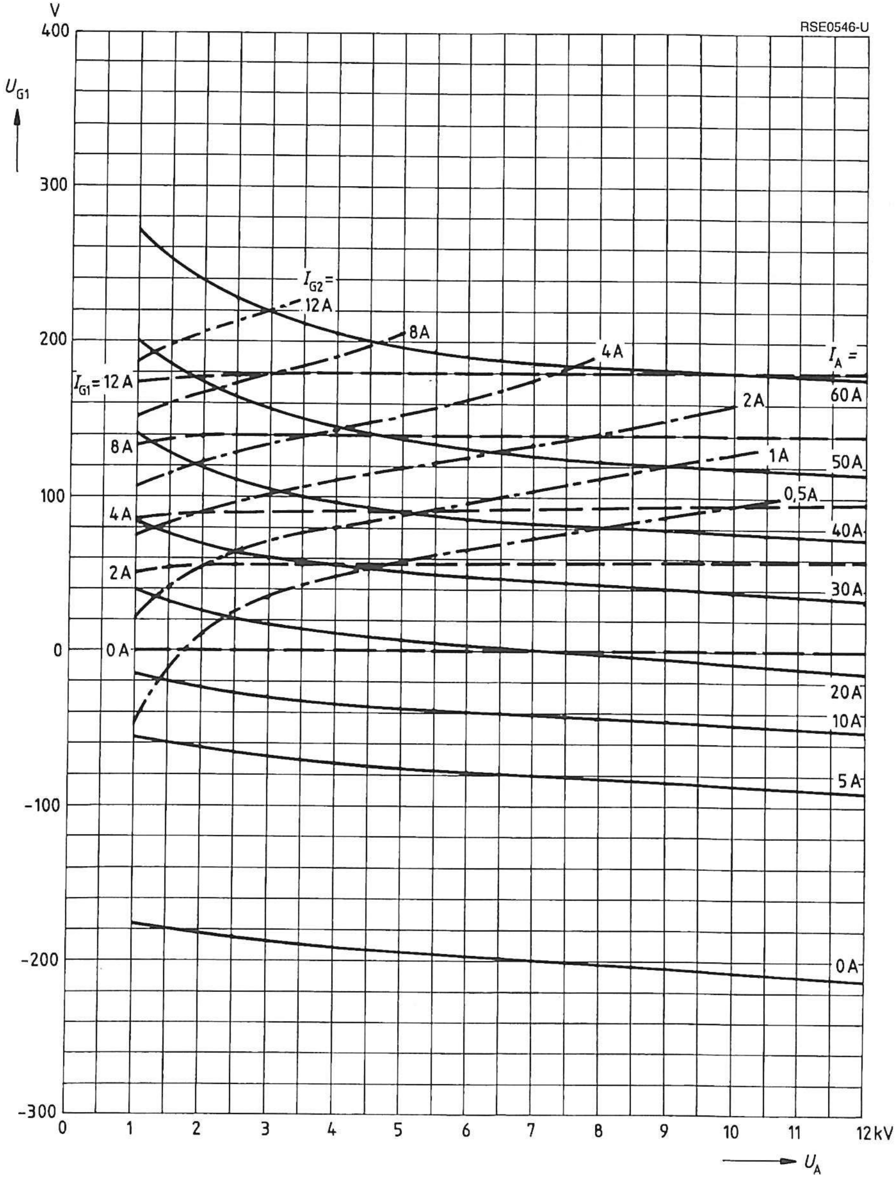
Anode screen-grid circuit



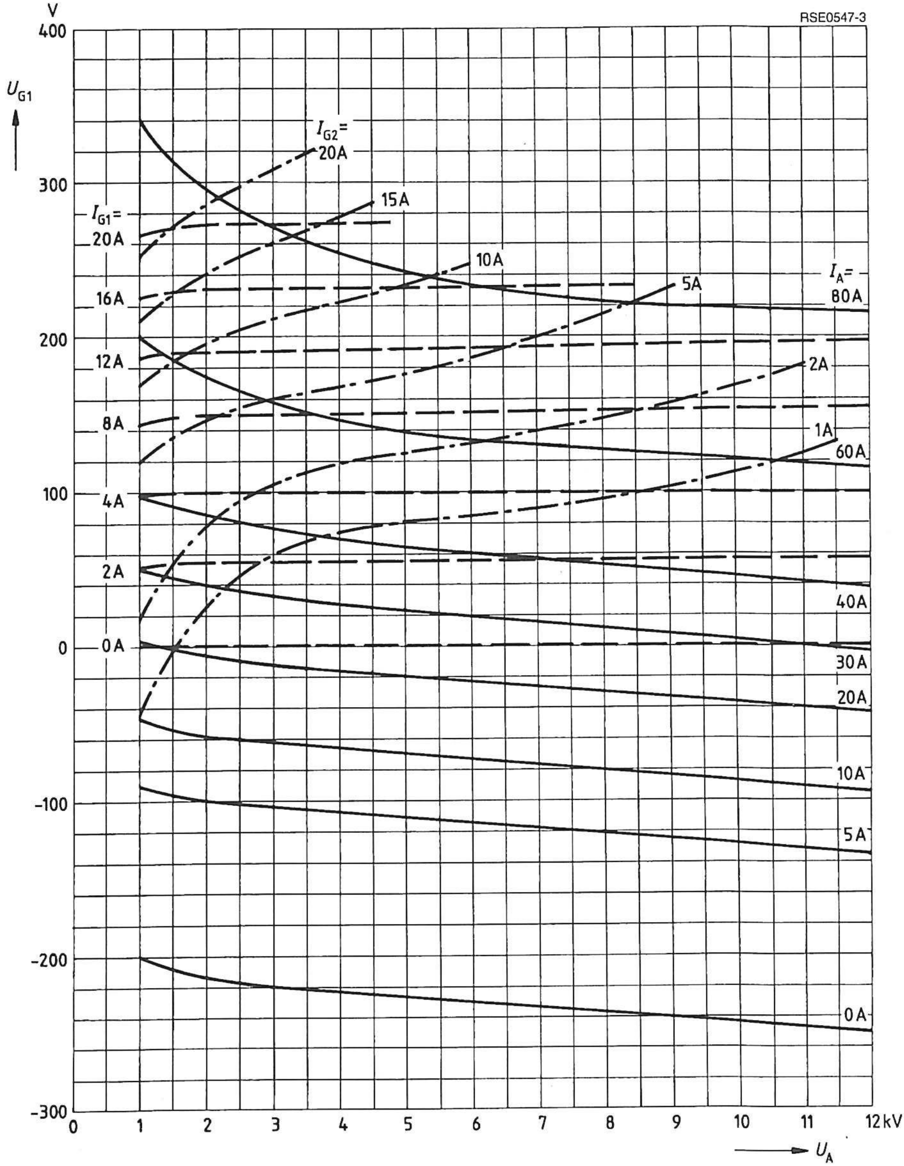


$U_{G1} = f(U_A)$
$U_{G2} = 700$ V

Parameter = I_A ————
Parameter = I_{G2} —·—·—·—
Parameter = I_{G1} — — — —

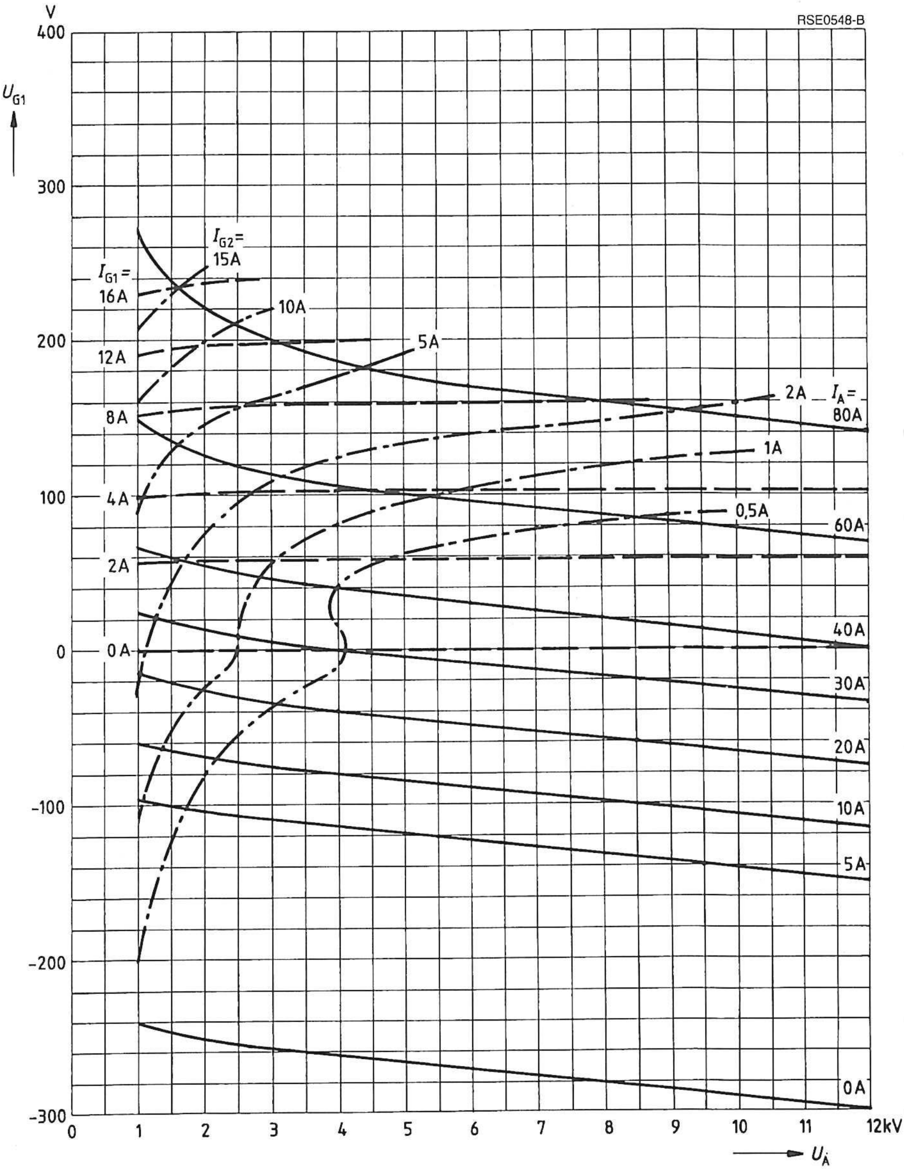


$U_{G1} = f(U_A)$ Parameter = I_A ————
$U_{G2} = 900$ V Parameter = I_{G2} —·—·—·—
Parameter = I_{G1} — — — —



$U_{G1} = f(U_A)$
$U_{G2} = 1100$ V

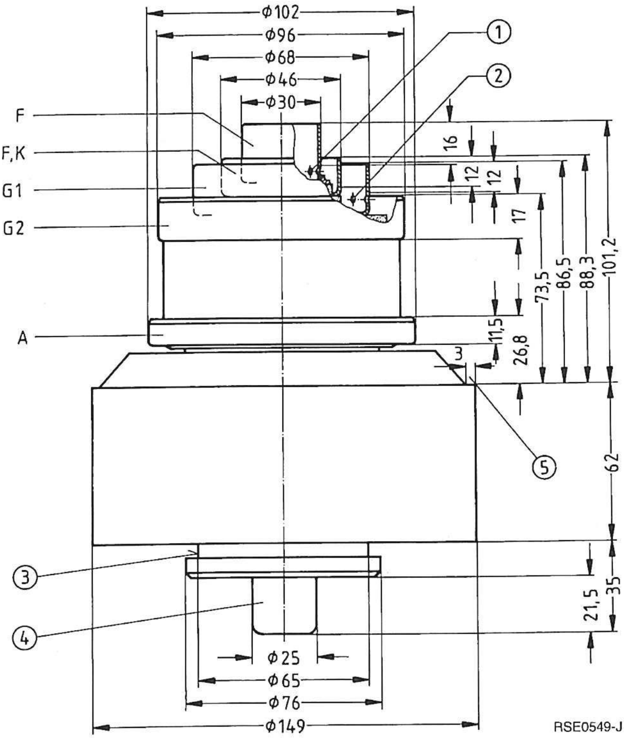
Parameter = I_A ————————
Parameter = I_{G2} —·—·—·—·—
Parameter = I_{G1} — — — — — —



For frequencies up to 110 MHz

Ordering code Q51-X2064

Coaxial metal-ceramic tetrode, forced-air-cooled, for frequencies up to 110 MHz, particularly suitable for FM transmitters in grounded control-grid screen-grid circuit.



Dimensions in mm

① 8 holes 3 mm dia. (8 × 45°)
② 12 holes 3 mm dia. (12 × 30°)
③ Accommodation for tube filter
④ Do not use as terminal
⑤ Free for anode support

Approx weight 5,5 kg

The radiator and the terminals are of concentric design with the following diameters:

Radiator	Ø 153,0	Control grid terminal	Ø 69,0
Screen grid terminal	Ø 97,0	Heater, cathode terminal	Ø 46,6
		Heater terminal	Ø 30,6

Heating

Heater voltage	U_F	9,0	V
Heater current	I_F	≈ 112	A
Heating: direct			
Cathode: thoriated tungsten			

Characteristics

Emission current at $U_A = U_{G2} = U_{G1} = 300$ V	I_{em}	40	A
Amplification factor of screen grid at $U_A = 2$ kV, $U_{G2} = 600$ to 1000V, $I_A = 3$ A	μ_{g2g1}	7,0	
Transconductance at $U_A = 2$ kV, $U_{G2} = 800$ V, $I_A = 2$ to 4 A	S	80	mA/V

Capacitances

Cathode/control grid	c_{kg1}	≈ 82	pF
Cathode/screen grid	c_{kg2}	≈ 6,0	pF
Cathode/anode	c_{ka}	≈ 0,07	pF [1)]
Control grid/screen grid	c_{g1g2}	≈ 128	pF
Control grid/anode	c_{g1a}	≈ 0,78	pF [1)]
Screen grid/anode	c_{g2a}	≈ 21	pF

Accessories

Upon request

1) Measured by means of a 50 cm diameter screening plate in the screen grid terminal plane.

RF amplifier,
class B operation, grounded control-grid screen-grid circuit

Maximum ratings

Frequency	f	110	MHz
Anode voltage (dc)	U_A	12	kV
Screen grid voltage (dc)	U_{G2}	1000	V
Control grid voltage (dc)	U_{G1}	– 250	V
Cathode current (dc)	I_K	6,0	A
Peak cathode current	I_{KM}	35	A
Anode dissipation	P_A	10	kW
Screen grid dissipation	P_{G2}	270	W
Control grid dissipation	P_{G1}	70	W

Operating characteristics

Frequency	f	≤ 110	MHz
Output power	P_2	11,2 + 0,16 [2])	kW [1])
Power gain	V_p	18,5	dB
Anode voltage (dc)	U_A	9,0	kV
Screen grid voltage (dc)	U_{G2}	600	V
Control grid voltage (dc)	U_{G1}	– 130	V
Peak control grid voltage (ac)	$U_{g1\,m}$	110	V
Anode current (dc)	I_A	1,7	A
Screen grid current (dc)	I_{G2}	70	mA
Anode input power	P_{BA}	15,3	kW
Drive power	P_1	160	W [1])
Anode dissipation	P_A	4,1	kW
Screen grid dissipation	P_{G2}	42	W
Efficiency	η	73	%
Anode load resistance	R_A	3000	Ω

1) Circuit losses are not included.
2) Power transition of grounded control-grid screen-grid circuit.

Tube mounting

Axis vertical, anode up or down.

Maximum tube surface temperature

The temperature of the tube's metal-ceramic seals must not exceed 220 °C at any point and the temperature of the internal cathode terminal must not exceed 250 °C. These requirements can be met without additional cooling of the terminals, if an appropriate air duct and sufficient space between the individual contact springs is provided so that enough cooling air can pass through.

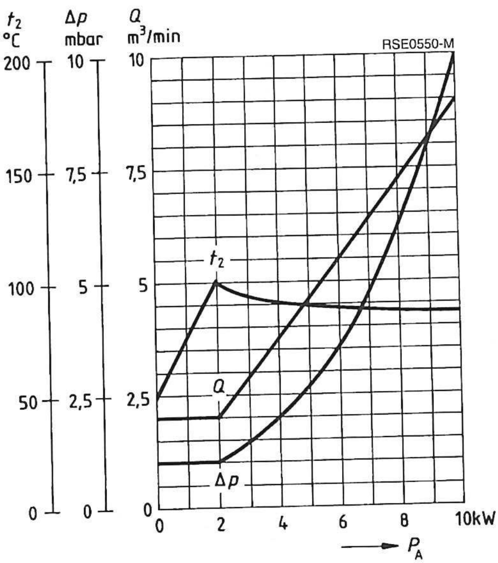
Forced-air cooling

The minimum air flow rate required for maximum anode dissipation is given in the cooling air diagram valid for 25 °C inlet temperature at a normal air pressure of 1 bar (sea level). The cooling air must be supplied from the side of the electrode terminals. For further information on forced-air cooling refer to "Explanations on Technical Data".

Safety precautions

The section "Safety precautions" under "Explanations on Technical Data" describes how the tube is to be protected against damage due to electric overload or insufficient cooling. A copper wire with 0,20 mm diameter should be used to test the anode overcurrent trip circuit.

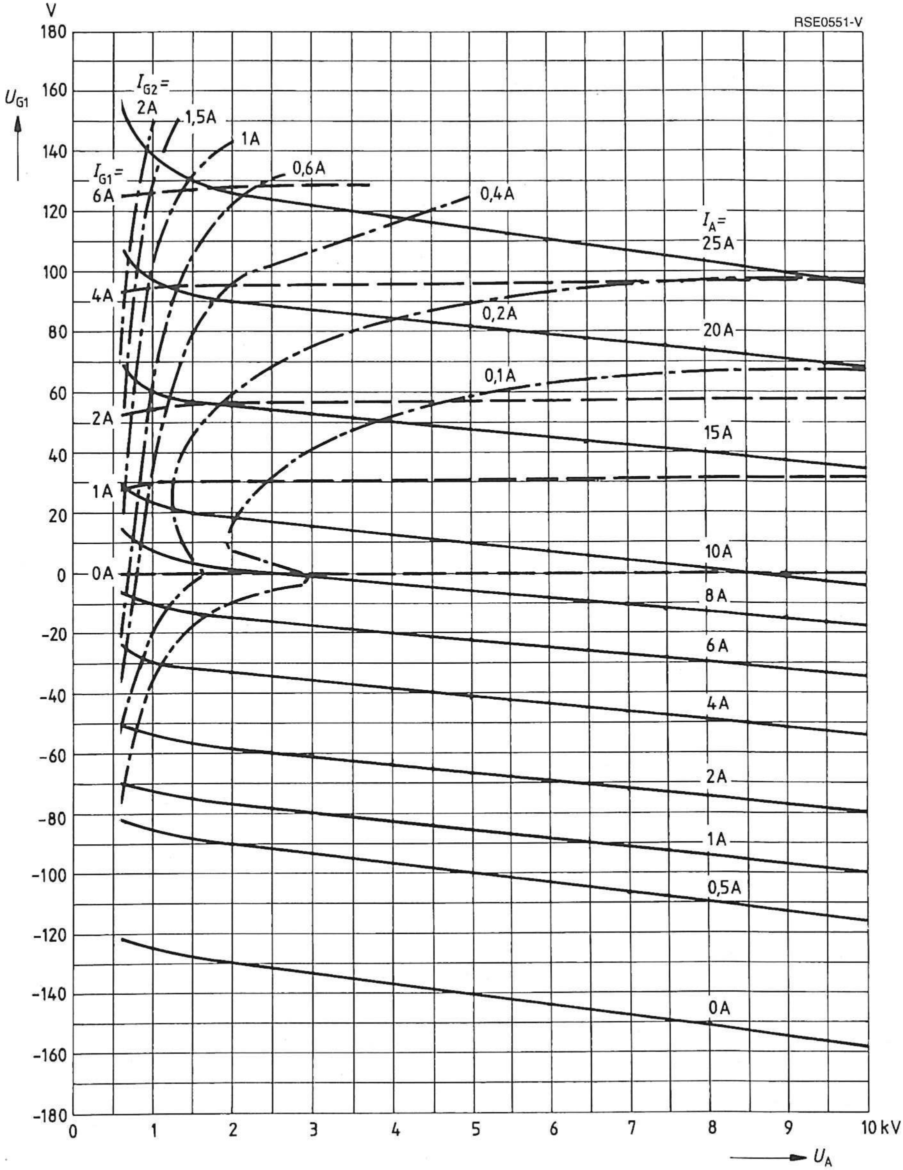
Cooling air diagram



The cooling air is supplied from the electrode terminal side.

Air pressure = 1 bar
t_1 = 25 °C

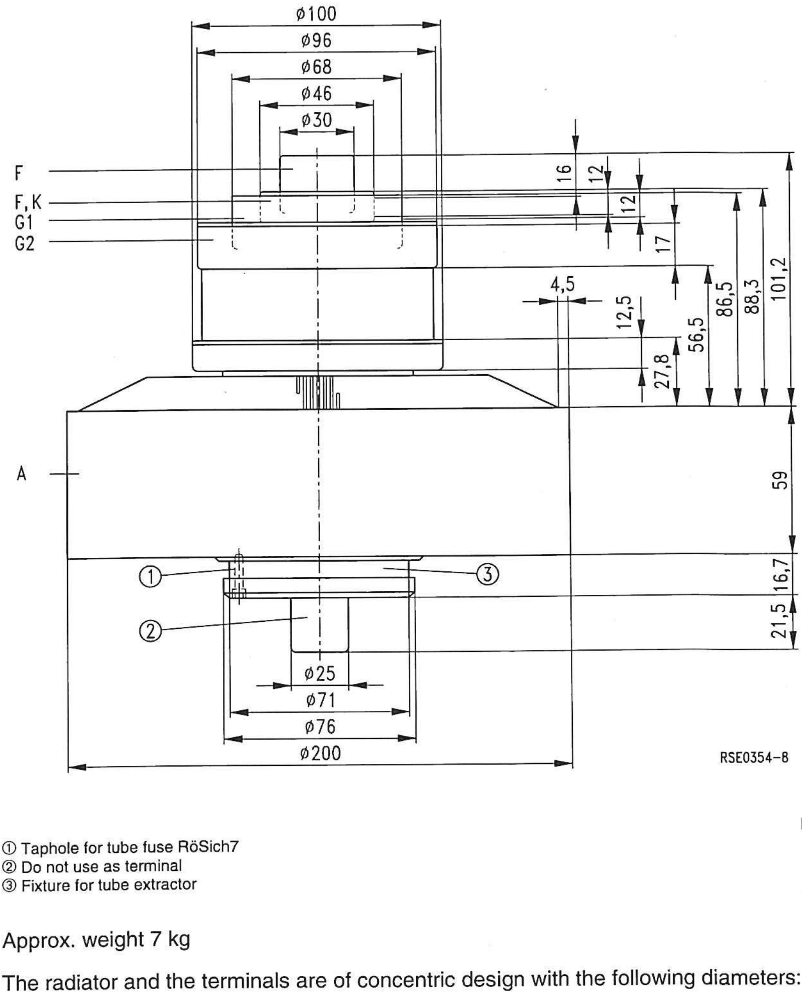
$U_{G1} = f(U_A)$ Parameter = I_A ———————
$U_{G2} = 600$ V Parameter = I_{G2} —·—·—·—·—
Parameter = I_{G1} — — — — — —



VX

Ordering code Q51-X2068

Metal-ceramic tetrode with coaxial lead-throughs, especially suitable for FM transmitters in grounded control-grid screen-grid-circuits.



Dimensions in mm

① Taphole for tube fuse RöSich7
② Do not use as terminal
③ Fixture for tube extractor

Approx. weight 7 kg

The radiator and the terminals are of concentric design with the following diameters:

Radiator	Ø 203,5	Control grid terminal	Ø 69,0
Screen grid terminal	Ø 97,0	Heater, cathode terminal	Ø 46,6
		Heater terminal	Ø 30,6

Heating

Heater voltage	U_F	9,0	V
Heater current	I_F	≈ 112	A
Heating: direct			
Cathode: thoriated tungsten			

Characteristics

Emission current at $U_A = U_{G2} = U_{G1} = 300$ V	I_{em}	40	A
Amplification of screen grid at $U_A = 2$ kV, $U_{G2} = 600$ to 1000V, $I_A = 3$ A	μ_{g2g1}	7,0	
Transconductance at $U_A = 2$ kV, $U_{G2} = 800$ V, $I_A = 2$ to 4 A	S	80	mA/V

Capacitances

Cathode/control grid	c_{kg1}	≈ 82	pF
Cathode/screen grid	c_{kg2}	≈ 6	pF
Cathode/anode	c_{ka}	≈ 0,09	pF [1])
Control grid/screen grid	c_{g1g2}	≈ 128	pF
Control grid/anode	c_{g1a}	≈ 0,78	pF [1])
Screen grid/anode	c_{g2a}	≈ 21	pF

Accessories		Ordering code
Tube extractor	RöZub264	Q81-X2120
Cavities on request		

1) Measured by means of a 50 cm diameter screening plate in the screen grid terminal plane.

RF amplifier, class B operation, grounded control-grid screen-grid circuit

Maximum ratings

Frequency	f	110	MHz
Anode voltage (dc)	U_A	12	kV
Screen grid voltage (dc)	U_{G2}	1000	V
Control grid voltage (dc)	U_{G1}	– 250	V
Cathode current (dc)	I_K	6,0	A
Peak cathode current	$I_{K\,M}$	35	A
Anode dissipation	P_A	16	kW
Screen grid dissipation	P_{G2}	270	W
Control grid dissipation	P_{G1}	70	W

Operating characteristics

Frequency	f	≤ 110	≤ 110	MHz
Output power	P_2	22,0	11,3	kW[1][2]
Power gain	V_p	17	18,5	dB
Anode voltage (dc)	U_A	9,0	9,0	kV
Screen grid voltage (dc)	U_{G2}	800	600	V
Control grid voltage (dc)	U_{G1}	– 180	– 165	V
Peak control grid voltage (ac)	$U_{g1\,m}$	170	130	V
Anode current (dc)	I_A	3,4	1,7	A
Screen grid current (dc)	I_{G2}	170	70	mA
Anode input power	$P_{B\,A}$	30,6	15,3	kW
Drive power	P_1	440	160	W
Anode dissipation	P_A	8,2	4,1	kW
Efficiency	η	71	73	%
Anode load resistance	R_A	1400	3000	Ω

1) Circuit losses are not included.
2) Drive power is included.

Tube mounting

Axis vertical, anode up or down.

Maximum tube surface temperature

The temperature of the tube's metal-ceramic seals must not exceed 220 °C at any point and the temperature of the internal cathode terminal must not exceed 250 °C. These requirements can be met without additional cooling of the terminals, if the cooling air is appropriately channeled and if the spacing of the contact springs allows sufficient air to pass.

Forced-air cooling

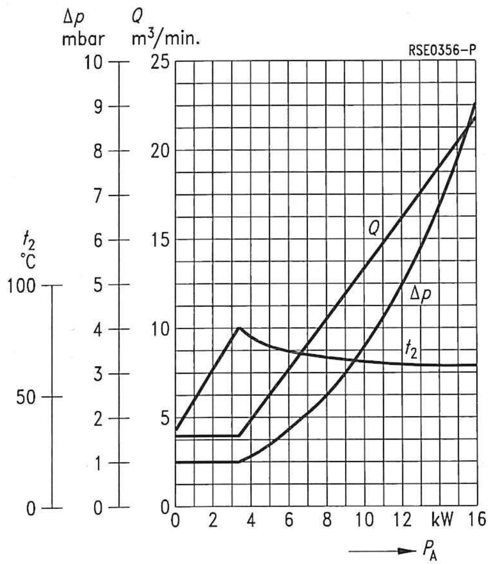
The minimum air flow rate required for maximum anode dissipation is given in the cooling air diagram, valid for 25 °C inlet temperature at a normal air pressure of 1 bar (sea level). The cooling air must be supplied from the side of the electrode terminals. For further information on forced-air cooling refer to "Explanations on Technical Data".

Safety precautions

The section "Safety precautions" describes how the tube is to be protected against damage due to electric overload or insufficient cooling. A copper wire with 0,20 mm diameter should be used to test the anode overcurrent trip circuit.

During operation the air flow and temperature have to be monitored, since in case of malfunction the voltages applied to the tube must be automatically disconnected.

Cooling air diagram



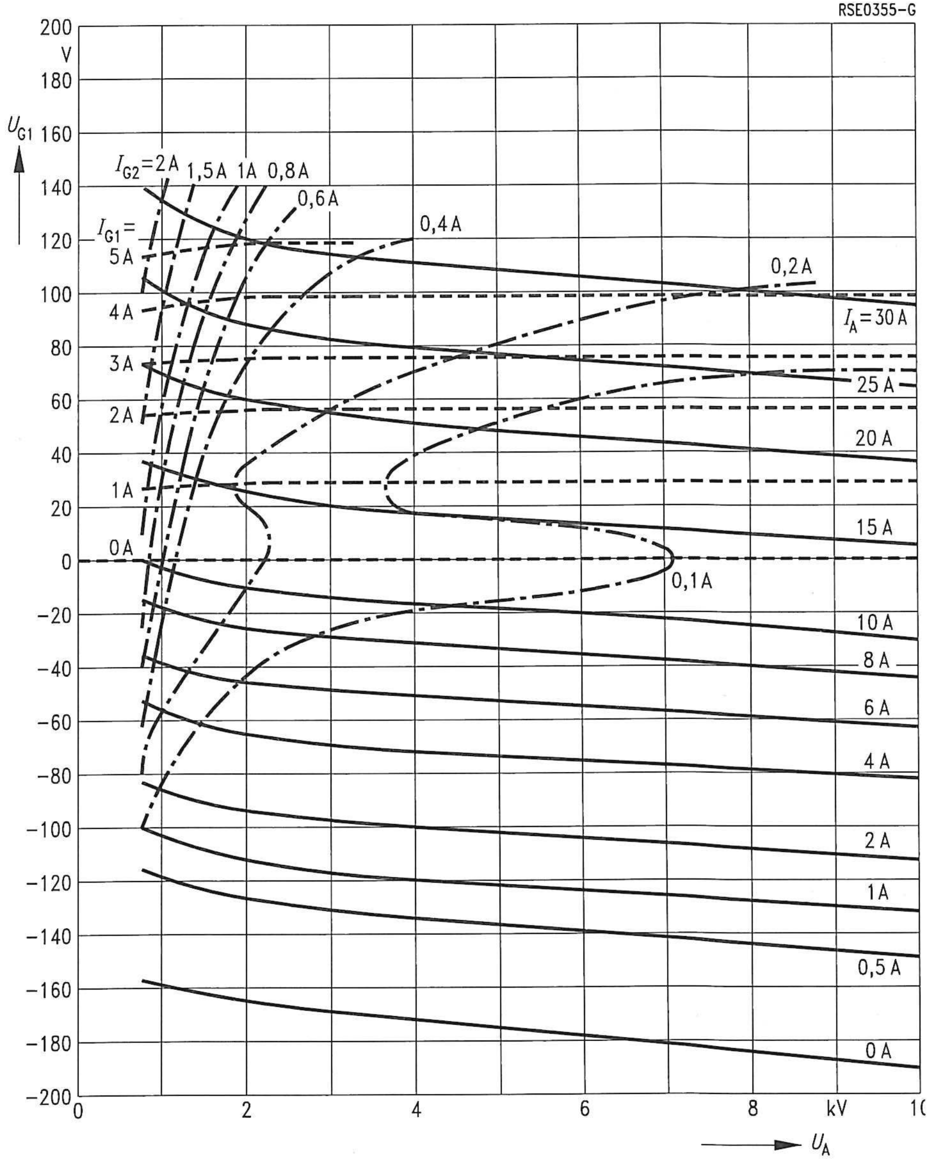
The cooling air is supplied from the electrode terminal side.

Air pressure = 1 bar

t_1 = 25 °C

$U_{G1} = f(U_A)$
$U_{G2} = 800$ V

Parameter = I_A ————
Parameter = I_{G2} —·—·—·—
Parameter = I_{G1} — — — —

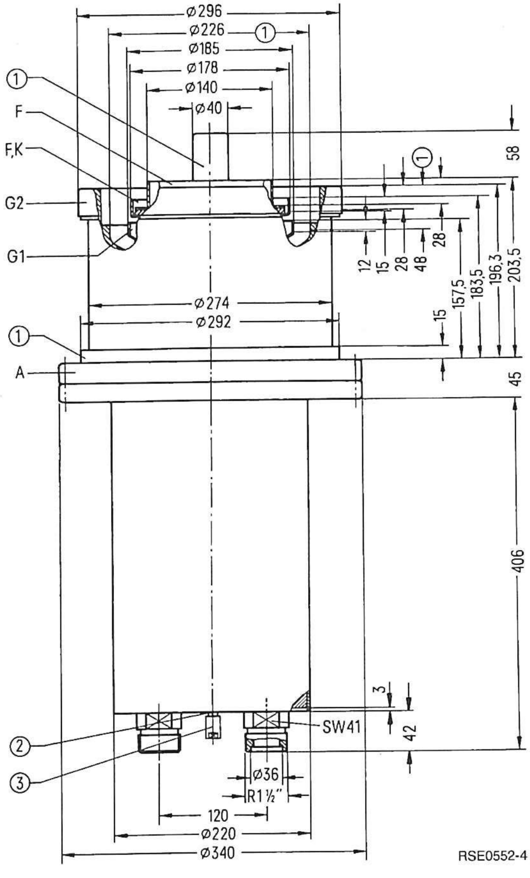


Ordering code Q53-X2074 (RS 2074 SK)
Ordering code Q53-X274 (RS 2074 HF)

Coaxial metal-ceramic tetrode, vapor-condensation-cooled. Due to the favorable current transfer characteristic and the high permissible screen-grid dissipation this tube features very high efficiency.

The version RS 2074 SK is particularly suitable for broadcast transmitters up to 600 kW medium wave and 500 kW short wave, for grid-current free operated modulators in transmitters up to 1000 kW, and for use as switching tube in PDM transmitters up to 1000 kW.

The version RS 2074 HF is particularly suitable for RF amplifiers up to 900 kW/up to 110 MHz.



Dimensions in mm

① Do not use as terminal
② Taphole M12 for screw ring conveyer RöZub105
③ Connector for drain hose with 5 mm internal width

Approx. weight 72 kg

Heating

Heater voltage	U_F	13,5	V
Heater current	I_F	≈ 920	A
Permissible starting current	$I_{F M}$	≤ 3000	A
Heating: direct			
Cathode: thoriated tungsten			

Characteristics

Emission current at $U_A = U_{G2} = U_{G1} = 700$ V	I_{em}	600	A
Amplification factor of screen grid at $U_A = 6$ kV, $U_{G2} = 800$ to 1200 V, $I_A = 20$ A	μ_{g21g}	4,5	
Transconductance at $U_A = 6$ kV, $U_{G2} = 1100$ V, $I_A = 50$ A	s	480	mA/V

Capacitances

Cathode/control grid	c_{kg1}	≈ 430	pF
Cathode/screen grid	c_{kg2}	≈ 45	pF
Cathode/anode	c_{ka}	≈ 1,2	pF 1)
Control grid/screen grid	c_{g1g2}	≈ 620	pF
Control grid/anode	c_{g1a}	≈ 7	pF 1)
Screen grid/anode	c_{g2a}	≈ 125	pF

Accessories		**Ordering code**
Cathode connecting strip (4 per tube)	RöKat272	Q81-X1109
SW header socket	RöKpf275	Q81-X1859
Screw ring conveyor	RöZub105	Q1001-X148
Insulating hose	RöZub274SK	Q81-X2178
LL electrolytic target for $1^1/_4$" hose	RöEI7	Q81-X512

1) Measured by means of a 60 cm diameter screening plate in the screen grid terminal plane.

RF amplifier,
class B operation, grounded control-grid screen-grid circuit

Maximum ratings

Frequency	f	110	MHz
Anode voltage (dc)	U_A	24	kV
Screen grid voltage (dc)	U_{G2}	1600	V
Control grid voltage (dc)	U_{G1}	– 1200	V
Cathode current (dc)	I_K	100	A
Peak cathode current	$I_{K\,M}$	650	A
Anode dissipation	P_A	500	kW [2]
Screen grid dissipation	P_{G2}	6,0	kW
Control grid dissipation	P_{G1}	2,0	kW

Operating characteristics

Frequency	f	50	MHz
Output power	P_2	600	kW [1]
Anode voltage (dc)	U_A	16	kV
Screen grid voltage (dc)	U_{G2}	1500	V
Control grid voltage (dc)	U_{G1}	– 500	V
Peak control grid voltage (ac)	$U_{g1\,m}$	700	V
Anode current (dc)	I_A	53	A
Screen grid current (dc)	I_{G2}	2	A
Control grid current (dc)	I_{G1}	3,3	A
Anode input power	$P_{B\,A}$	848	kW
Drive power	P_1	35	kW [1]
Anode dissipation	P_A	248	kW
Screen grid dissipation	P_{G2}	3	kW
Control grid dissipation	P_{G1}	600	W
Efficiency	η	67	%
Anode load resistance	R_A	172	Ω

1) Circuit losses are not included.
2) Higher max. ratings may be released upon request.

RF amplifier, pulse operation, class B operation, grounded control-grid screen-grid circuit

Maximum ratings

Frequency	f	110	MHz
Anode voltage (dc)	U_A	24	kV
Screen grid voltage (dc)	U_{G2}	1600	V
Control grid voltage (dc)	U_{G1}	– 1200	V
Cathode current (dc)	I_K	100	A
Peak cathode current	I_{KM}	650	A
Anode dissipation	P_A	500	kW [4]
Screen grid dissipation	P_{G2}	6,0	kW
Control grid dissipation	P_{G1}	2,0	kW

Operating characteristics

Frequency	f	108	MHz
Pulse duration	t_p	5×10^{-3}	s
Pulse separation	t_0	15×10^{-3}	s
Pulse output power	$P_{2\,p}$	1550 + 60 [3]	kW [1]
Anode voltage (dc)	U_A	23	kV
Screen grid voltage (dc)	U_{G2}	1,5	kV
Control grid voltage (dc)	U_{G1}	– 650	V [2]
Peak control grid voltage (ac)	$U_{g1\,m\,p}$	720	V
Pulse anode current (dc)	$I_{A\,p}$	104	A
Pulse screen grid current (dc)	$I_{G2\,p}$	3	A
Pulse control grid current (dc)	$I_{G1\,p}$	3	A
Pulse anode input power	$P_{B\,A\,p}$	2390	kW
Pulse drive power	$P_{1\,p}$	1 + 60 [3]	kW [1]
Pulse anode dissipation	$P_{A\,p}$	835	kW
Average anode dissipation	P_A	312	kW
Pulse screen grid dissipation	$P_{G2\,p}$	3,5	kW
Pulse control grid dissipation	$P_{G1\,p}$	100	W
Pulse efficiency	η_p	65	%
Anode load resistance	R_A	115	Ω

1) Circuit losses are not included.
2) For zero signal dc anode current $I_{A\,0} = 6$ A.
3) Power transition of grounded control-grid screen-grid circuit.
4) Higher max. ratings may be released upon request.

Anode and screen grid modulation, class C operation, grounded cathode circuit, with 3-*f* circuits

Maximum ratings

Frequency	f	30	MHz
Anode voltage (dc)	U_A	15	kV
Screen grid voltage (dc)	U_{G2}	2200	V
Control grid voltage (dc)	U_{G1}	– 1200	V
Cathode current (dc)	I_K	100	A
Peak cathode current	$I_{K\,M}$	650	A
Anode dissipation	P_A	500	kW 5)
Screen grid dissipation	P_{G2}	8,0	kW
Control grid dissipation	P_{G1}	3,0	kW

Operating characteristics

Frequency	f	3	MHz
Carrier power	P_{trg}	620	kW 1)
Anode voltage (dc)	U_A	12	kV
Screen grid voltage (dc)	U_{G2}	1200	V
Control grid bias (dc), fixed	$U_{G1\,fix}$	– 550	V
Control grid resistance	R_{G1}	25	Ω
Peak control grid voltage (ac)	$U_{g1\,m}$	920	V
Anode current (dc)	I_A	58	A
Screen grid current (dc)	I_{G2}	4,4	A
Control grid current (dc)	I_{G1}	6,5	A
Anode input power	$P_{B\,A}$	766	kW
Drive power	P_1	6,0	kW 1)
Anode dissipation	P_A	146	kW 2)
Screen grid dissipation	P_{G2}	5,3	kW
Control grid dissipation	P_{G1}	2,4	kW
Efficiency	η	89	%
Anode load resistance	R_A	135	Ω
Modulation factor	m	100	%
Peak screen grid voltage (ac)	$U_{g2\,m}$	700	V
Modulation power	P_{mod}	420	kW
Control grid current (dc)	I_{G1}	9,1	A 3)
Drive power	P_1	9,8	kW1)3)
Anode dissipation at modulation	$P_{A\,mod}$	255	kW 4)
Screen grid dissipation at modulation	$P_{G2\,mod}$	6,4	kW 4)

1) Circuit losses are not included.
2) Even during modulation the indicated maximum ratings must not be exceeded. It has to be observed that during 100 % modulation the anode dissipation increases to about 1,5 times the power dissipation stated for the carrier value.
3) Maximum values at $U_A = 0$ V.
4) Average values at $m = 100$ %.
5) Higher max. ratings may be released upon request.

Anode and screen grid modulation, class C operation, grounded cathode circuit

Maximum ratings

Frequency	f	30	MHz
Anode voltage (dc)	U_A	15	kV
Screen grid voltage (dc)	U_{G2}	2200	V
Control grid voltage (dc)	U_{G1}	– 1200	V
Cathode current (dc)	I_K	100	A
Peak cathode current	$I_{K\,M}$	650	A
Anode dissipation	P_A	500	kW [5])
Screen grid dissipation	P_{G2}	8	kW
Control grid dissipation	P_{G1}	3	kW

Operating characteristics

Frequency	f	≤ 30	MHz
Carrier power	P_{trg}	525	kW [1])
Anode voltage (dc)	U_A	12	kV
Screen grid voltage (dc)	U_{G2}	1100	V
Control grid bias (dc), fixed	$U_{G1\,fix}$	– 550	V
Control grid resistance	R_{G1}	30	Ω
Peak control grid voltage (ac)	$U_{g1\,m}$	880	V
Anode current (dc)	I_A	54	A
Screen grid current (dc)	I_{G2}	3,3	A
Control grid current (dc)	I_{G1}	4,9	A
Anode input power	$P_{B\,A}$	648	kW
Drive power	P_1	4,2	kW [1])
Anode dissipation	P_A	123	kW [2])
Screen grid dissipation	P_{G2}	3,7	kW
Control grid dissipation	P_{G1}	800	W
Efficiency	η	81	%
Anode load resistance	R_A	112	Ω
Modulation factor	m	100	%
Peak screen grid voltage (ac)	$U_{g2\,m}$	700	V
Modulation power	P_{mod}	355	kW
Control grid current (dc)	I_{G1}	6,4	A [3])
Drive power	P_1	5	kW[1])[3])
Anode dissipation at modulation	$P_{A\,mod}$	215	kW [4])
Screen grid dissipation at modulation	$P_{G2\,mod}$	4,5	kW [4])

1) Circuit losses are not included.
2) Even during modulation the indicated maximum ratings must not be exceeded. It has to be observed that during 100 % modulation the anode dissipation increases to about 1,5 times the power dissipation stated for the carrier value.
3) Maximum values at $U_A = 0$ V.
4) Average values at $m = 100$ %.
5) Higher max. ratings may be released upon request.

AF amplifier and modulator, class B operation, 2 tubes in push-pull circuit, $I_{G1} = 0$

Maximum ratings

Anode voltage (dc)	U_A	15	kV
Screen grid voltage (dc)	U_{G2}	2200	V
Control grid voltage (dc)	U_{G1}	– 1200	V
Cathode current (dc)	I_K	100	A
Peak cathode current	I_{KM}	650	A
Anode dissipation	P_A	500	kW
Screen grid dissipation	P_{G2}	8,0	kW
Control grid dissipation	P_{G1}	3,0	kW

Operating characteristics

at modulator operation for

		1000 kW carrier power		
Output power	P_2	0	600	kW
Anode voltage (dc)	U_A	12	12	kV
Screen grid voltage (dc)	U_{G2}	1500	1500	V
Control grid voltage (dc)	U_{G1}	– 450	– 450	V
Peak control grid voltage (ac) between the 2 tubes	$U_{gg\,m}$	0	860	V
Anode current (dc)	I_A	2 × 1,8	2 × 37,6	A
Screen grid current (dc)	I_{G2}	0	2 × 3,5	A
Anode input power	P_{BA}	2 × 22	2 × 451	kW
Anode dissipation	P_A	2 × 22	2 × 150	kW
Screen grid dissipation	P_{G2}	0	2 × 4,7	kW
Efficiency	η	—	66,5	%
Effective load resistance (anode to anode)	R_{AA}	—	348	Ω

Tube mounting

Axis vertical, anode up or down.

For connection of the tube use the terminals listed under "Accessories".

Maximum tube surface temperature

The maximum temperature of the tube surface must not exceed 220 °C. The maximum permissible temperature difference at the tube circumference is 50 °C. The temperature gradient at the tube must not exceed 25 °C/cm. The surface temperature will remain below the maximum values if an air stream of approx. 5 to 6 m^3/min is directed onto the tube terminals.

Vapor condensation cooling

The cooling water diagram gives the minimum water flow rate (distilled or deionized water) for maximum anode dissipation, as well as pressure drop and water outlet temperature at 60 °C water inlet temperature. The diagram applies to a hermetically sealed cooling system with 1.5 bar overpressure at the cooling water outlet with a maximum permissible outlet temperature of 100 °C.

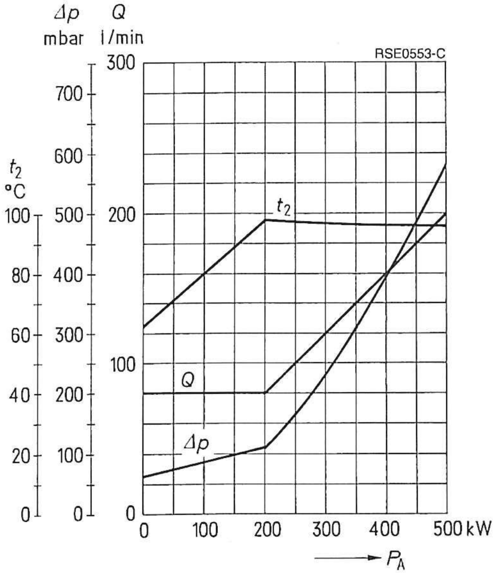
Operation with open cooling cycle (without overpressure) is possible if the maximum outlet temperature remains below 60 °C (sea level, air pressure ≈ 1 bar) with lower inlet temperature and, if required, increased water flow rate.

For more information on vapor condensation cooling refer to "Explanations on Technical Data".

Safety precautions

The section "Safety precautions" under "Explanations on Technical Data" describes how the tube is to be protected against damage due to electric overload or insufficient cooling. A copper wire with 0,35 mm diameter should be used to test the anode overcurrent trip circuit.

Cooling air diagram



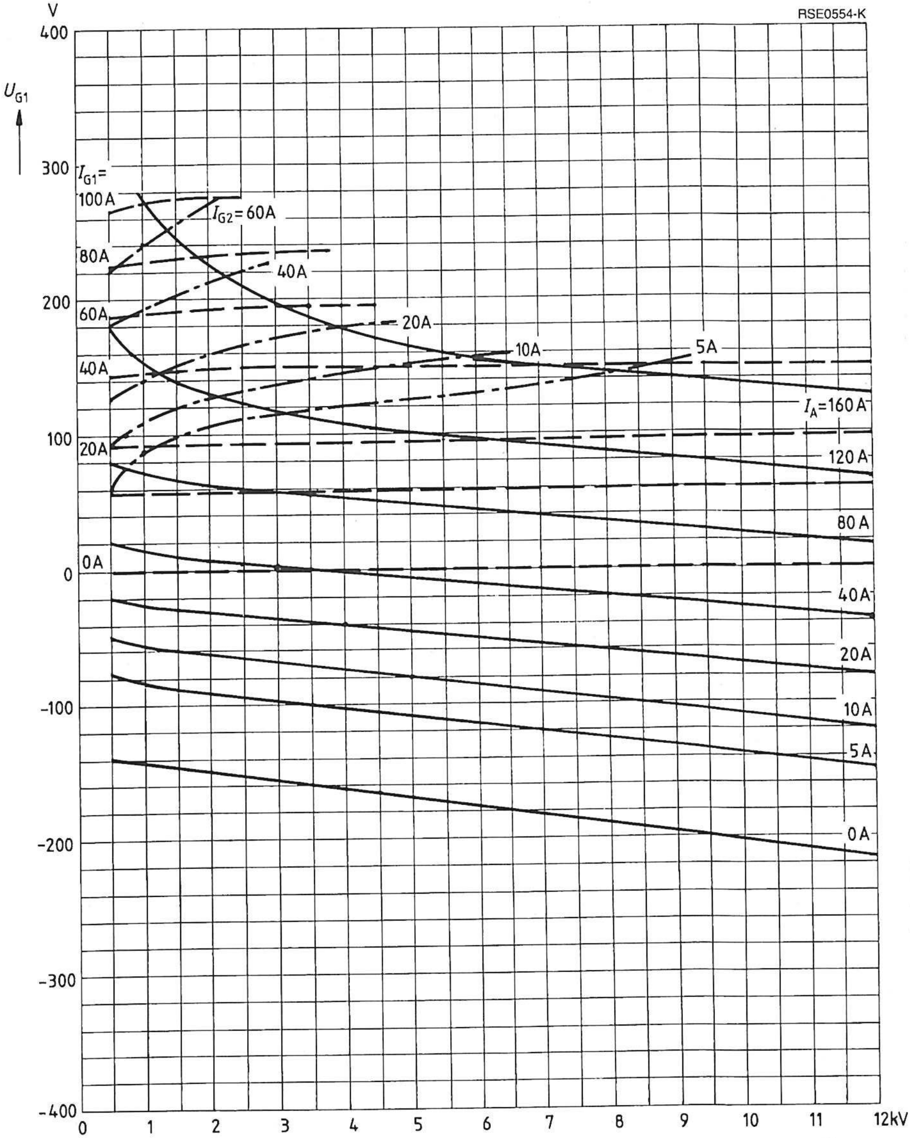
The cooling air is supplied from the electrode terminal side.

Air pressure = 1,5 bar

t_1 = 60 °C

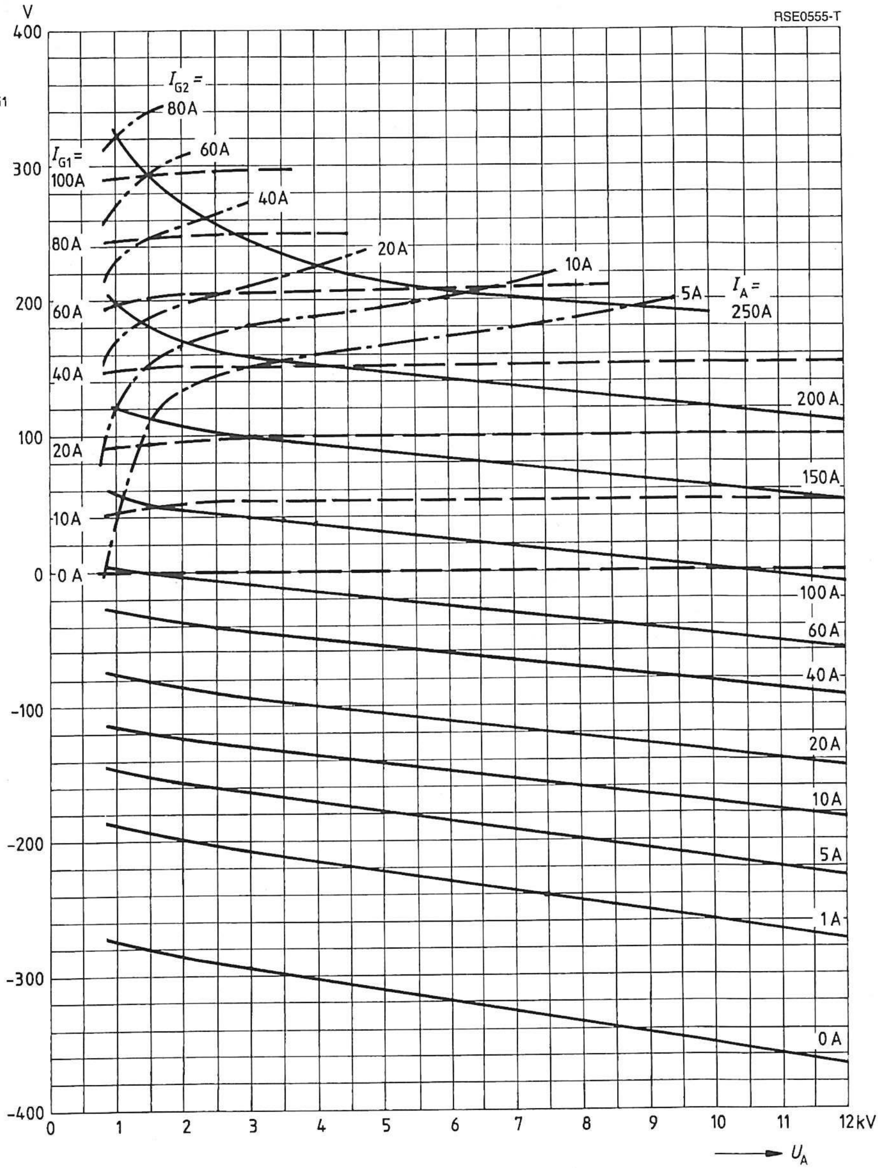
$U_{G1} = f(U_A)$
$U_{G2} = 500$ V

Parameter = I_A ————————
Parameter = I_{G2} —·—·—·—·—
Parameter = I_{G1} — — — — — —



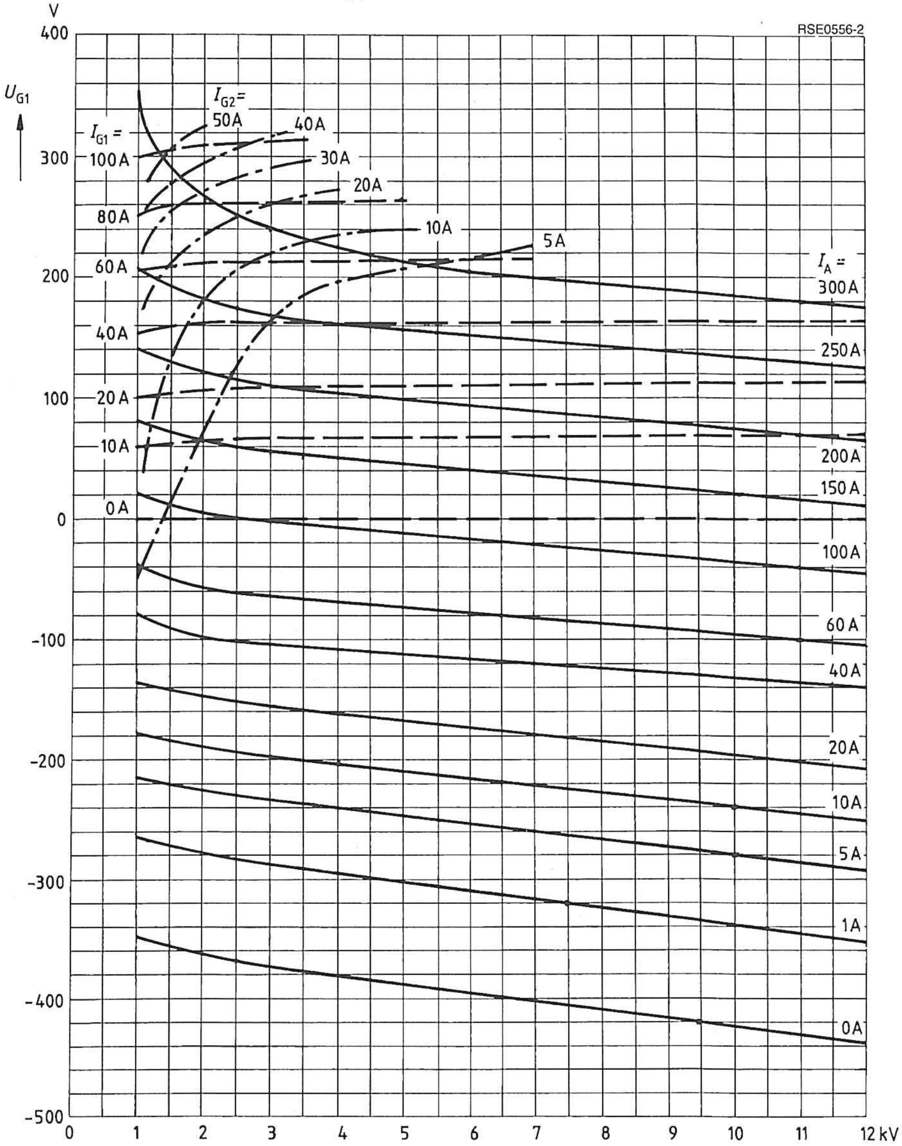
$U_{G1} = f(U_A)$
$U_{G2} = 800$ V

Parameter = I_A
Parameter = I_{G2}
Parameter = I_{G1}

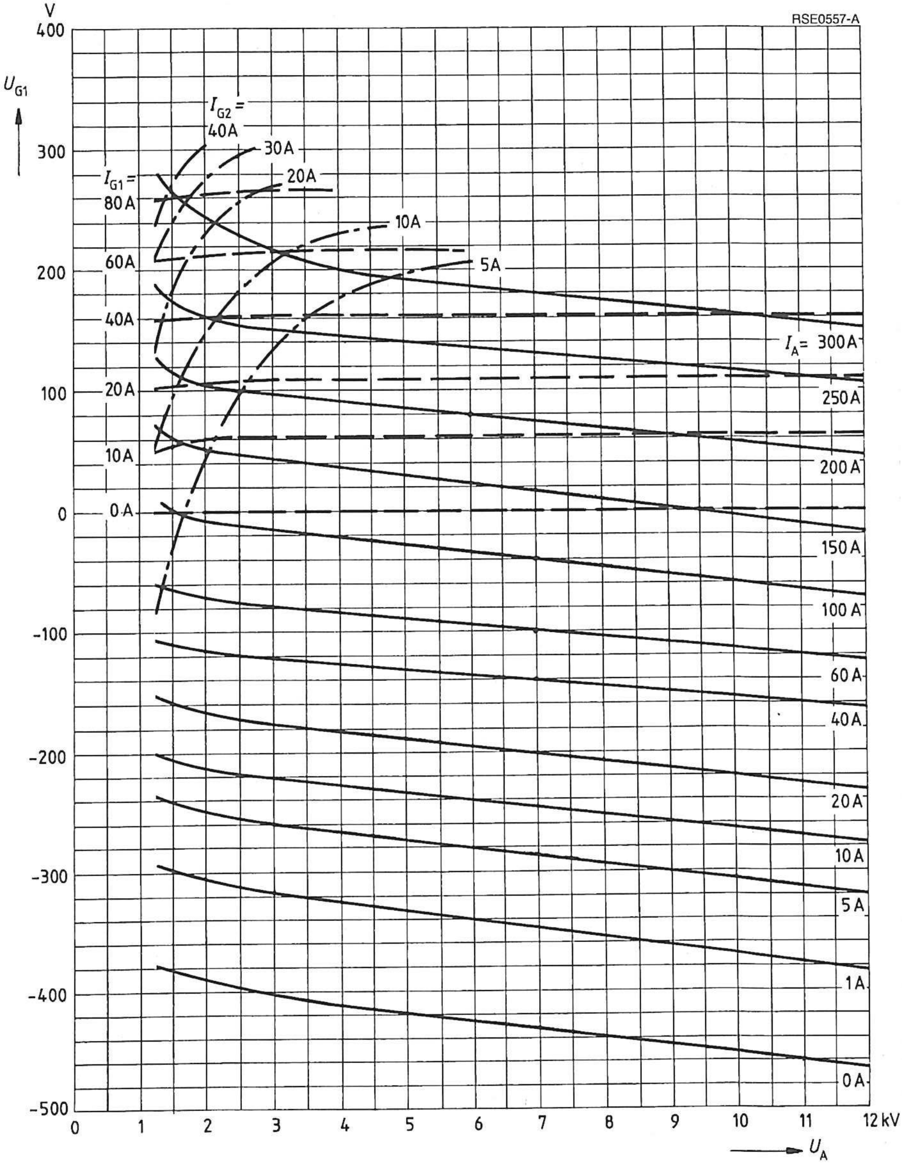


$U_{G1} = f(U_A)$
$U_{G2} = 1100$ V

Parameter = I_A ————————
Parameter = I_{G2} —·—·—·—·—
Parameter = I_{G1} — — — — — —

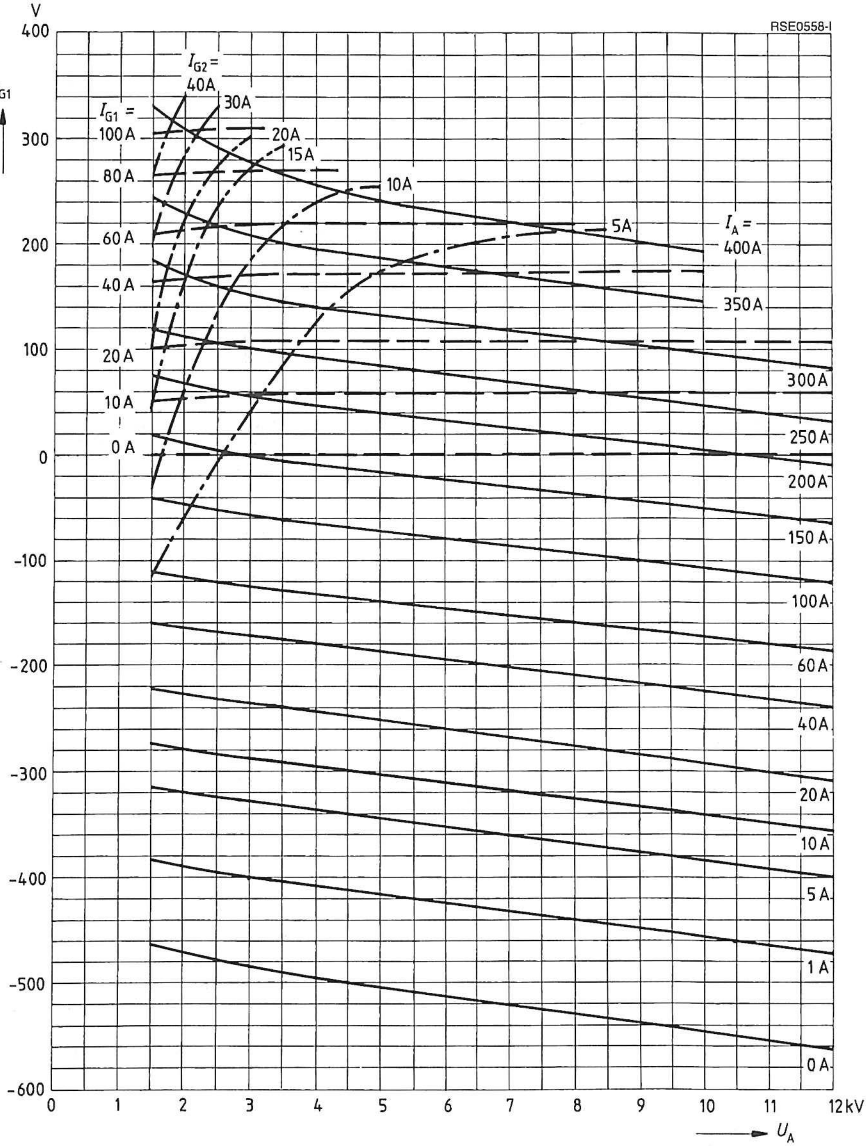


$U_{G1} = f(U_A)$ Parameter = I_A ————
$U_{G2} = 1200$ V Parameter = I_{G2} —·—·—·—
Parameter = I_{G1} — — — —



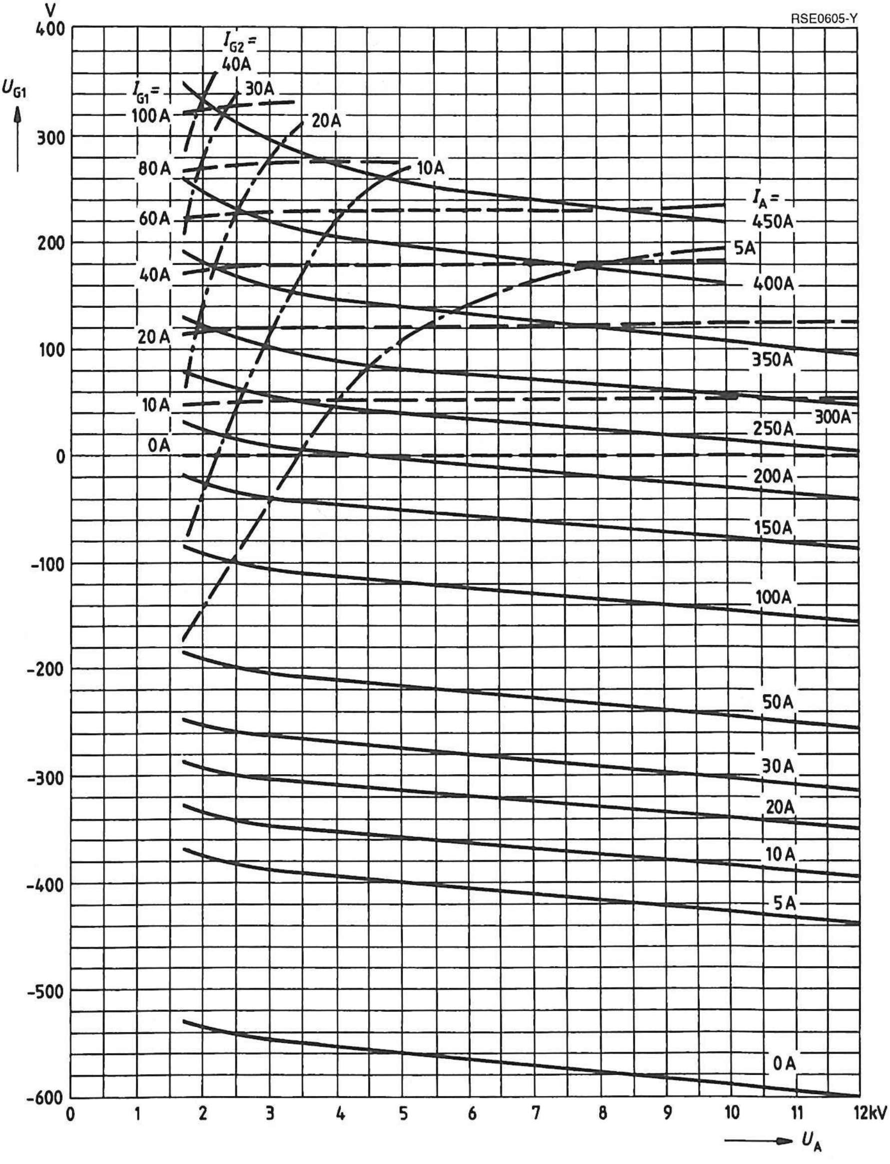
VX

$U_{G1} = f(U_A)$ Parameter = I_A ————————
$U_{G2} = 1500$ V Parameter = I_{G2} —·—·—·—·—
Parameter = I_{G1} — — — — — — —



$U_{G1} = f(U_A)$
$U_{G2} = 1750$ V

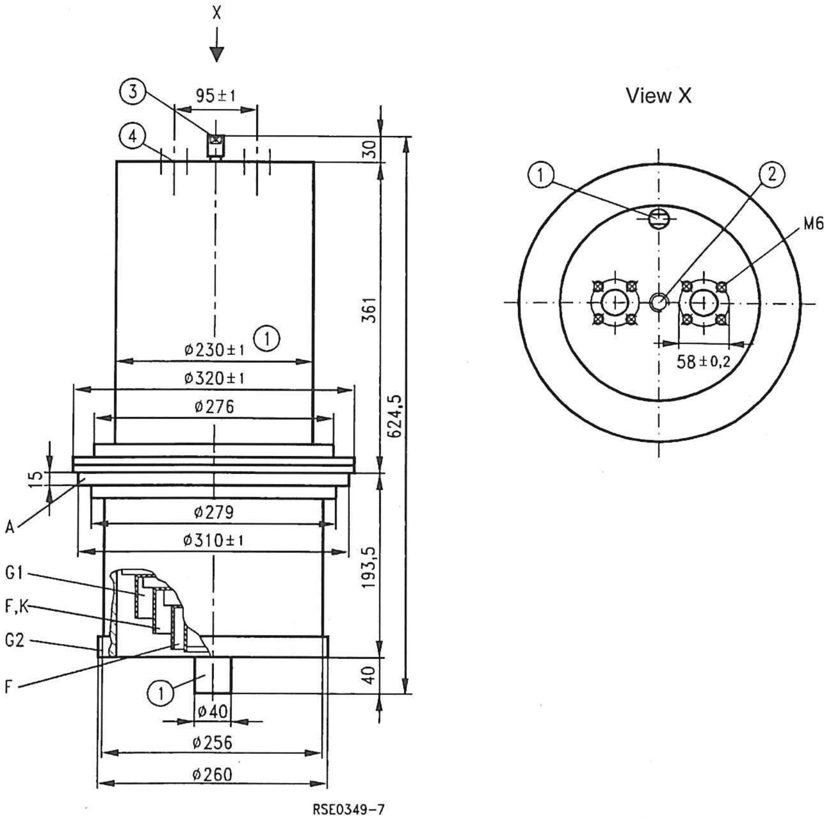
Parameter = I_A ————————
Parameter = I_{G2} —·—·—·—·—
Parameter = I_{G1} — — — — — —



Ordering code Q53-X2078

Coaxial metal-ceramic tetrode, grid in pyrolytic graphite technolgy, vapor-condensation-cooled. The tube's excellent efficiency results from its favorable current transfer characteristic and high permissible screen grid dissipation.

The RS 2078 SK is particularly suitable for up to 600 kW MW and 500 kW SW broadcast transmitters and as switching tube in PDM transmitters.



Dimensions in mm

① Do not use as terminal
② Taphole M14 for screw ring conveyer RöZub278
③ Terminal for suction lifter with 6 mm hose diameter
④ 4 tapholes M6 on 58 mm dia.

Approx. weight 75 kg

Heating

Heater voltage	U_F	23	V [1])
Heater current	I_F	550	A
Permissible starting current	$I_{F\,M}$	≤ 1300	A
Heating: direct			
Cathode: thoriated tungsten			

Characteristics

Emission current at $U_A = U_{G2} = U_{G1} = 700$ V	I_{em}	600	A
Amplification factor of screen grid at $U_A = 5$ kV, $U_{G2} = 800$ to 1200V, $I_A = 10$ A	μ_{g2g1}	5,0	
Transconductance at $U_A = 5$ kV, $U_{G2} = 1100$ V, $I_A = 25$ to 55 A	S	520	mA/V

Capacitances

Cathode/control grid	c_{kg1}	480	pF
Cathode/screen grid	c_{kg2}	40	pF
Cathode/anode	c_{ka}	0,8	pF
Control grid/screen grid	c_{g1g2}	800	pF
Control grid/anode	c_{g1a}	6,0	pF
Screen grid/anode	c_{g2a}	110	pF

Accessories

Upon request

1) The heater voltage will be determined by the tube manufacturer for each individual application taking into account the respective operating conditions. The heating data specified above are guideline values.

Anode and screen grid modulation, class C operation, grounded cathode circuit

Maximum ratings

Frequency	f	110	MHz
Anode voltage (dc)	U_A	13,5	kV
Screen grid voltage (dc)	U_{G2}	1250	V
Control grid voltage (dc)	U_{G1}	– 800	V
Cathode current (dc)	I_K	100	A
Peak cathode current	$I_{K\,M}$	600	A
Anode dissipation	P_A	500	kW
Screen grid dissipation	P_{G2}	8,0	kW
Control grid dissipation	P_{G1}	3,0	kW

Operating characteristics

Frequency	f	≤ 30	MHz
Carrier power	P_{trg}	540	kW [1]
Anode voltage (dc)	U_A	12,5	kV
Screen grid voltage (dc)	U_{G2}	1100	V
Control grid bias (dc), fixed	$U_{G1\,fix}$	– 535	V
Peak control grid voltage (ac)	$U_{g1\,m}$	715	V
Anode current (dc)	I_A	53,5	A
Screen grid current (dc)	I_{G2}	2,8	A
Control grid current (dc)	I_{G1}	4,9	A
Anode input power	$P_{B\,A}$	669	kW
Drive power	P_1	3400	W [1]
Anode dissipation	P_A	129	kW [2]
Screen grid dissipation	P_{G2}	3000	W
Control grid dissipation	P_{G1}	700	W
Efficiency	η	81	%
Anode load resistance	R_A	120	Ω
Modulation factor	m	100	%
Peak screen grid voltage (ac)	$U_{g2\,m}$	800	V
Modulation power	P_{mod}	350	kW
Control grid current	I_{G1}	6,5	A [3]
Drive power	P_1	4500	W [1][3]
Anode dissipation at modulation	$P_{A\,mod}$	220	kW [4]
Screen grid dissipation at modulation	$P_{G2\,mod}$	3,7	kW [4]

1) Circuit losses are not included.
2) Even during modulation the maximum ratings must not be exceeded.
3) Maximum values at $U_A = 0$ V.
4) Average values at $m = 100$ %.

Tube mounting

Axis vertical, anode up or down.

Maximum tube surface temperature

The maximum surface temperature of the tube must not exceed 220 °C. The maximum permissible temperature difference at the circumference of the tube is 50 °C . Furthermore, temperature gradients at the tube must not be more than 25 °C/cm. To keep below these limit temperatures, an air stream should be directed onto the terminals.

Vapor condensation cooling

The cooling water diagram gives the minimum water flow rate (distilled or de-ionized water) for maximum anode dissipation, as well as pressure drop and water outlet temperatue at 60 °C water inlet temperature. The diagram applies to a hermetically sealed cooling system with less than1,5 bar overpressure at the tube's cooling water outlet and with a maximum permissible water outlet temperature of 100 °C.

Operation with open cooling cycle (without overpressure) is also possible if the maximum outlet temperature remains below 60 °C (sea level, air pressure ≈ 1 bar) with lower inlet temperature and, if required, increased water flow rate.

For more information on vapor condensation cooling refer to "Explanation of Technical Data" in the data book.

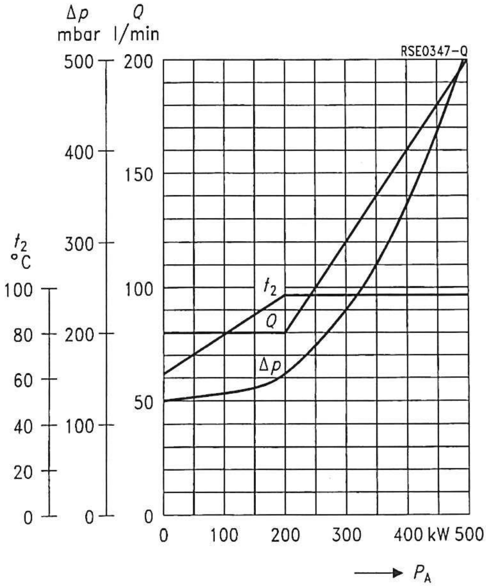
Safety precautions

Refer to "Explanation of Technical Data" in the data book for a desription on how to protect the tube against damage due to electrical overload or insufficient cooling. A copper wire with a diameter of 0,35 mm should be used to test the anode overcurrent trip circuit.

Switching on the heating

The heater voltage must be slowly increased (some minutes) until the specified value is reached. This requirement can be met by applying the heater voltage in 3 steps or by providing a motor-driven control transformer or a thyristor controller on the primary side of the heater transformer.

Cooling water diagram



Closed cooling cycle with distilled water

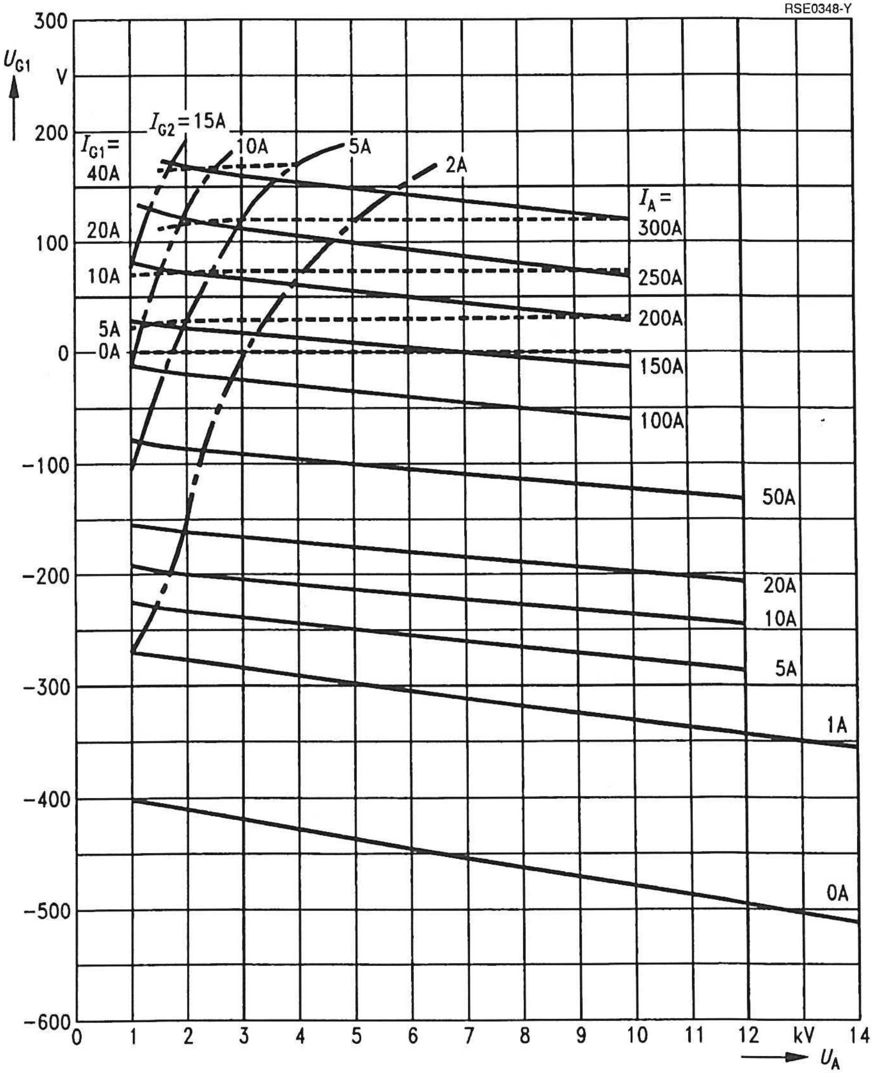
Overpressure = 1,5 bar

t_1 = 60 °C

$U_{G1} = f(U_A)$ Parameter = I_A ———————

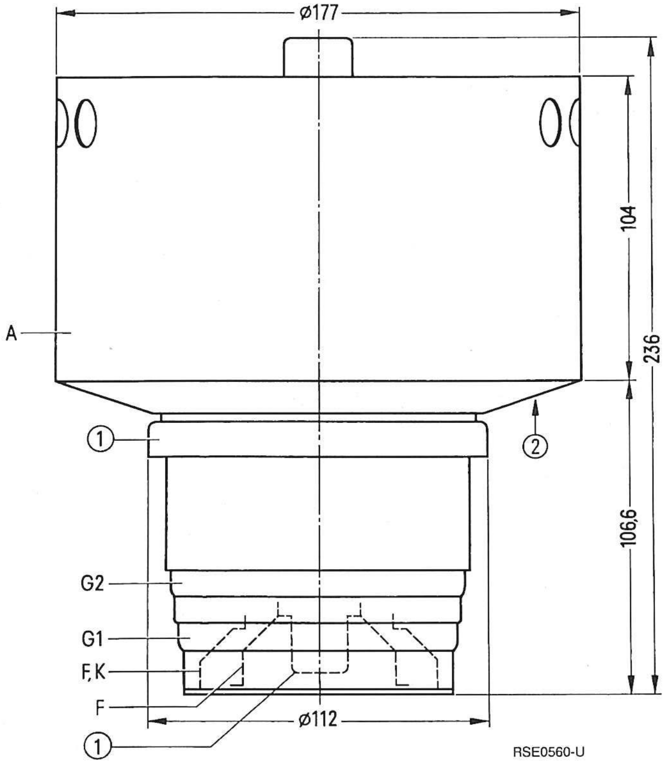
$U_{G2} = 800$ V Parameter = I_{G2} —·—·—·—·—

Parameter = I_{G1} — — — — — — —



Ordering code Q51-X2794

Coaxial metal-ceramic tetrode, forced-air-cooled, for frequencies up to 110 MHz, particularly suitable for single-sideband communications transmitters up to 11 kW.



Dimensions in mm

① Do not use as terminal
② Air inlet

Approx. weight 8,5 kg

Heating

Heater voltage	U_F	7,5	V
Heater current	I_F	≈ 75	A
Heating: direct			
Cathode: thoriated tungsten			

Characteristics

Emission current at $U_A = U_{G2} = U_{G1} = 400$ V	I_{em}	22	A
Amplification factor of screen grid at $U_A = 3$ kV, $U_{G2} = 750$ to 1000 V, $I_A = 2$ A	μ_{g2g1}	4,8	
Transconductance at $U_A = 3$ kV, $U_{G2} = 750$ V, $I_A = 2$ A	S	36	mA/V

Capacitances

Cathode/control grid	c_{kg1}	≈ 54	pF
Cathode/screen grid	c_{kg2}	≈ 6,0	pF
Cathode/anode	c_{ka}	≈ 0,2	pF 1)
Control grid/screen grid	c_{g1g2}	≈ 84	pF
Control grid/anode	c_{g1a}	≈ 1,0	pF 1)
Screen grid/anode	c_{g2a}	≈ 22,5	pF

Accessories		Ordering code
Socket (header connector)	RöFsg2794	Q1001-X27
Air duct	RöAnst2794	Q1001-X84

1) Measured by means of a 50 cm diameter screening plate in the screen grid terminal plane.

RF linear amplifier,
single-sideband modulation, grounded cathode circuit, $I_{G1} = 0$

Maximum ratings

Frequency	f	30	MHz
Anode voltage (dc)	U_A	8,0	kV
Screen grid voltage (dc)	U_{G2}	1,5	kV
Control grid voltage (dc)	U_{G1}	– 500	V
Cathode current (dc)	I_K	4,0	A
Peak cathode current	$I_{K\,M}$	22	A
Anode dissipation	P_A	12	kW
Screen grid dissipation	P_{G2}	300	W
Control grid dissipation	P_{G1}	75	W

Operating characteristics

Output power	P_2	0	12,5	6,25	kW [1]
Anode voltage (dc)	U_A	7,5	7,5	7,5	kV
Screen grid voltage (dc)	U_{G2}	1,25	1,25	1,25	kV
Control grid voltage	U_{G1}	– 260	– 260	– 260	V
Peak control grid voltage (ac)	$U_{g1\,m}$	0	240	240	V
Anode current (dc)	I_A	0,9	2,65	1,8	A
Screen grid current (dc)	I_{G2}	0	120	56	mA
Anode input power	$P_{B\,A}$	6,7	19,9	13,5	kW
Anode dissipation	P_A	6,7	7,4	7,25	kW
Screen grid dissipation	P_{G2}	0	150	70	W
Efficiency	η	—	63	46	%
Anode load resistance	R_A	—	1560	1560	Ω
Third order intermodulation product	d_3	—	—	≥ 44	dB [2]
Fifth order intermodulation product	d_5	—	—	≥ 50	dB [2]

I No modulation
II 1-tone modulation
III 2-tone modulation

1) Circuit losses are not included.
2) Intermodulation product calculated from the total characteristic measured by the differential method at $f \approx 3$ MHz.

Tube mounting

Axis vertical, anode up or down.

For connection of the tube use the terminals listed under “Accessories”.

Maximum tube surface temperature

The temperature of both the metal-ceramic seals and the anode body must not exceed 250 °C at any point.

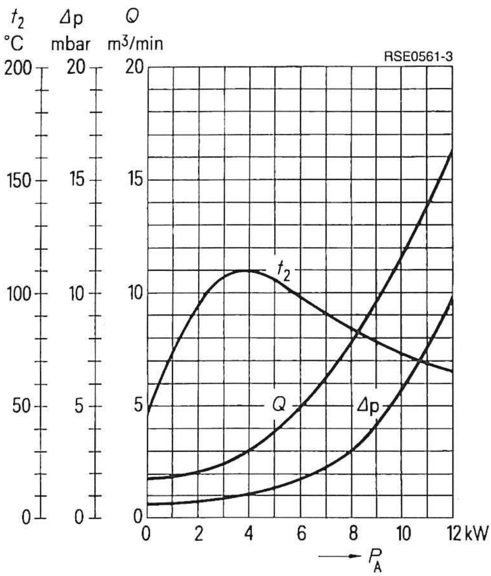
Forced-air cooling

The minimum air flow rate required for maximum anode dissipation is given in the cooling air diagram valid for 25 °C inlet temperature at a normal air pressure of 1 bar (sea level). The cooling air must be supplied from the side of the electrode terminals. For further information on forced-air cooling refer to “Explanations on Technical Data”.

Safety precautions

The section “Safety precautions” under “Explanations on Technical Data” describes how the tube is to be protected against damage due to electric overload or insufficient cooling. A copper wire with 0,20 mm diameter should be used to test the anode overcurrent trip circuit.

Cooling air diagram



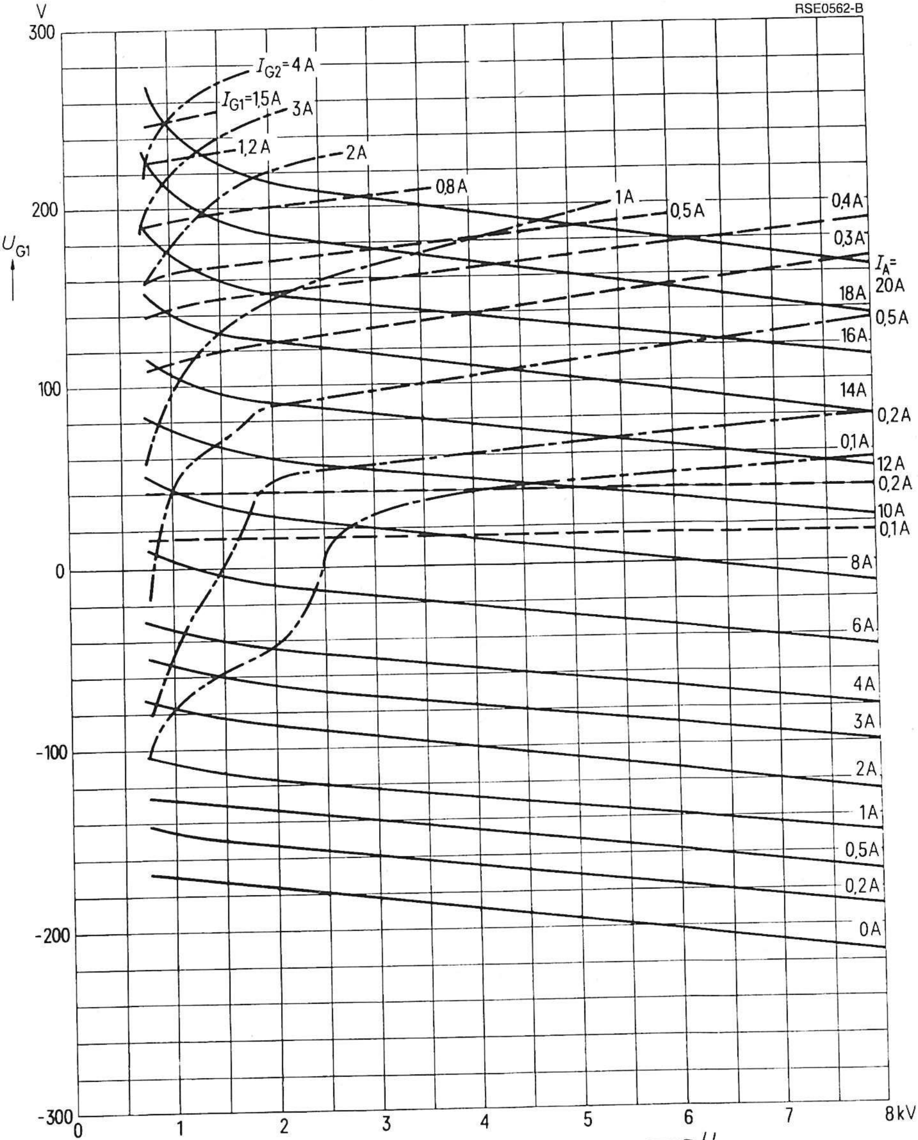
The cooling air is supplied from the electrode terminal side.

Air pressure = 1 bar

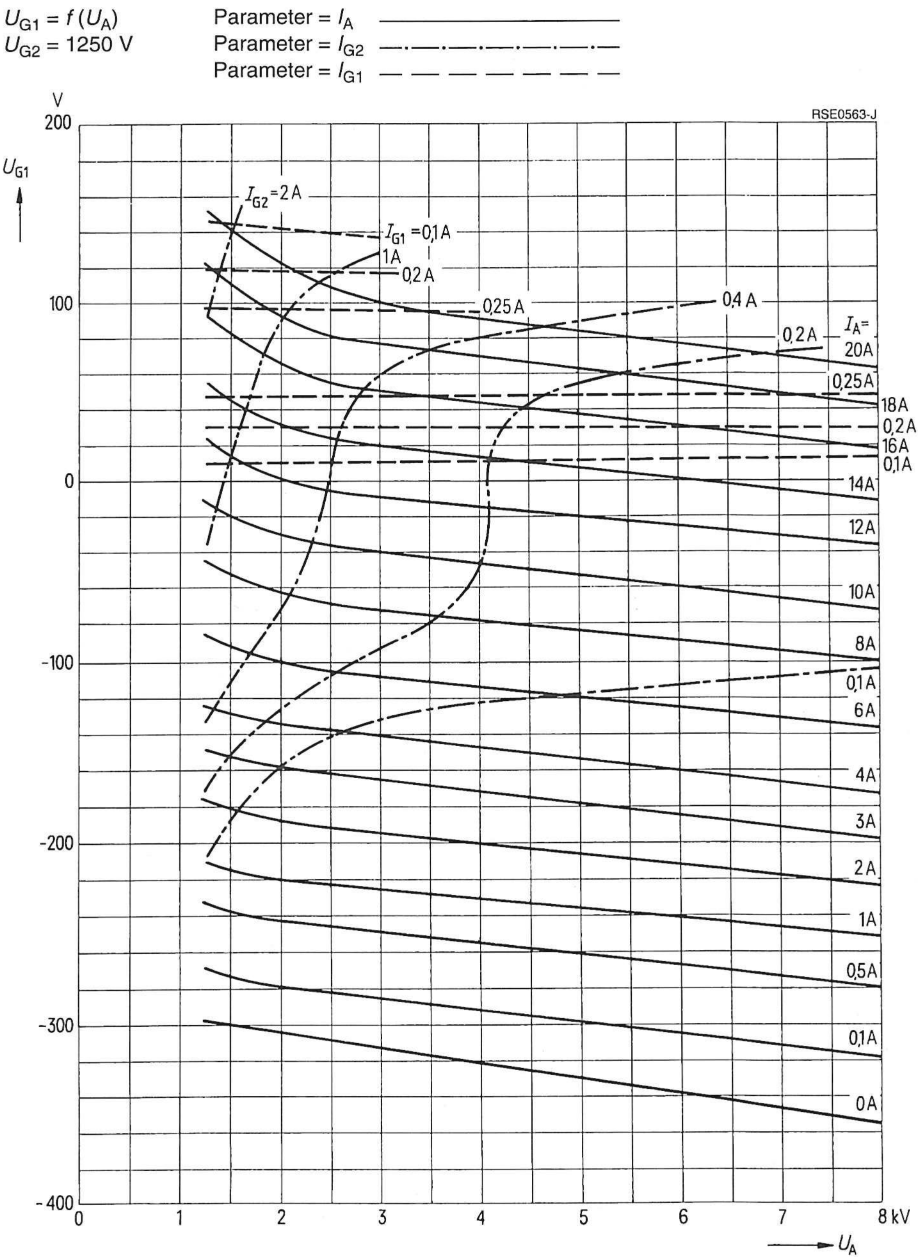
t_1 = 25 °C

$U_{G1} = f(U_A)$
$U_{G2} = 750$ V

Parameter = I_A ————
Parameter = I_{G2} —·—·—·—
Parameter = I_{G1} — — — —



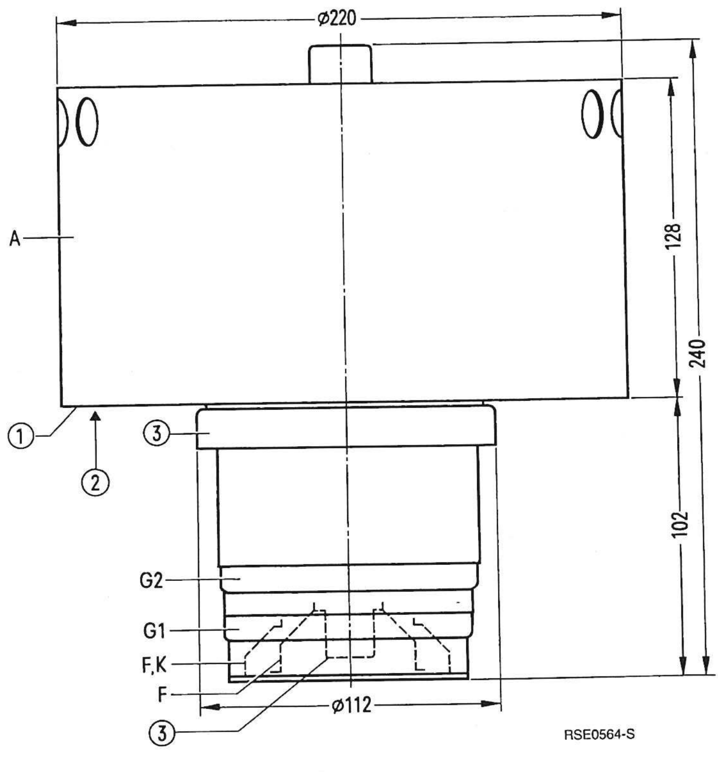
$U_{G1} = f(U_A)$
$U_{G2} = 1250$ V



VX

Ordering code Q53-X2795

Coaxial metal-ceramic tetrode, forced-air-cooled, for frequencies up to 110 MHz, particularly suitable for single-sideband communications transmitters up to 30 kW.



Dimensions in mm

① Tube support
② Air inlet
③ Do not use as terminal

Approx. weight 16 kg

Heating

Heater voltage	U_F	7,5	V
Heater current	I_F	≈ 115	A
Heating: direct			
Cathode: thoriated tungsten			

Characteristics

Emission current at $U_A = U_{G2} = U_{G1} = 400$ V	I_{em}	28	A
Amplification factor of screen grid at $U_A = 3$ kV, $U_{G2} = 1250$ to 1500 V, $I_A = 1{,}8$ A	μ_{g2g1}	4,8	
Transconductance at $U_A = 3$ kV, $U_{G2} = 1250$ V, $I_A = 2$ A	S	35	mA/V

Capacitances

Cathode/control grid	c_{kg1}	≈ 70	pF
Cathode/screen grid	c_{kg2}	≈ 8	pF
Cathode/anode	c_{ka}	≈ 0,18	pF [1])
Control grid/screen grid	c_{g1g2}	≈ 85	pF
Control grid/anode	c_{g1a}	≈ 1,2	pF [1])
Screen grid/anode	c_{g2a}	≈ 28	pF

Accessories		Ordering code
Socket (header connector)	RöFsg2795	Q1001-X28

1) Measured by means of a 50 cm diameter screening plate in the screen grid terminal plane.

RF linear amplifier, single-sideband modulation, grounded cathode circuit, I_{G1} = 0

Maximum ratings

Frequency	f	30	MHz
Anode voltage (dc)	U_A	11	kV
Peak anode voltage	$U_{A\,M}$	25	kV
Screen grid voltage (dc)	U_{G2}	1,6	kV
Control grid voltage (dc)	U_{G1}	– 600	V
Peak RF control grid voltage	$U_{g1\,m}$	600	V
Cathode current (dc)	I_K	28	A
Peak cathode current	$I_{K\,M}$	65	A
Anode dissipation	P_A	25	kW
Anode dissipation (for max. 20 s)	P_A	35	kW
Screen grid dissipation	P_{G2}	350	W
Control grid dissipation	P_{G1}	75	W
Control grid resistance	R_{G1}	10	kΩ

Operating characteristics

		I	II	III	
Output power	P_2	0	33	16,5	kW [1])
Anode voltage (dc)	U_A	10	10	10	kV
Screen grid voltage (dc)	U_{G2}	1,5	1,5	1,5	kV
Control grid voltage (dc)	U_{G1}	– 325	– 325	– 325	V
Peak control grid voltage (ac)	$U_{g1\,m}$	0	315	315	V
Anode current (dc)	I_A	1,8	5,25	3,8	A
Screen grid current (dc)	I_{G2}	0	220	110	mA
Anode input power	$P_{B\,A}$	18	52,5	38	kW
Anode dissipation	P_A	18	19,5	21,5	kW
Screen grid dissipation	P_{G2}	0	330	165	W
Efficiency	η	—	63	43,5	%
Anode load resistance	R_A	—	1070	1070	Ω
Third order intermodulation product	d_3	—	—	≥ 45	dB [2])
Fifth order intermodulation product	d_5	—	—	≥ 50	dB [2])

I No modulation
II 1-tone modulation
III 2-tone modulation

1) Circuit losses are not included.
2) Intermodulation product calculated from the total characteristic measured by the differential method at $f \approx 3$ MHz.

Tube mounting

Axis vertical, anode up.

Maximum tube surface temperature

The temperature of the metal-ceramic seals must not exceed 200 °C at any point and the temperature of the anode body must not exceed 220 °C. If an appropriate air duct is provided, the cooling air or part of it can be used to keep the maximum permissible temperature of the metal-ceramic seals.

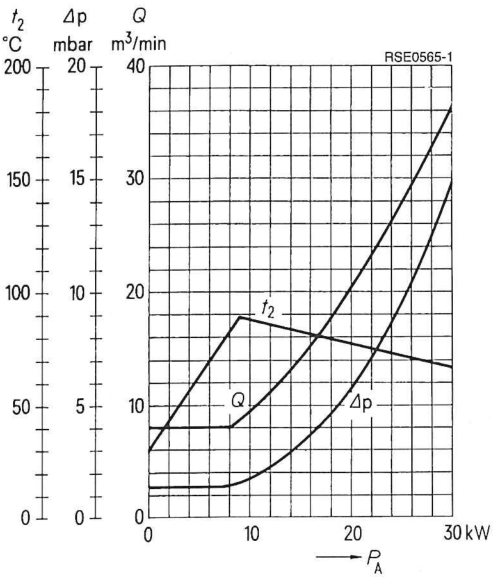
Forced-air cooling

The minimum air flow rate required for maximum anode dissipation is given in the cooling air diagram valid for 25 °C inlet temperature at a normal air pressure of 1 bar (sea level). The cooling air must be supplied from the side of the electrode terminals. For further information on forced-air cooling refer to "Explanations on Technical Data".

Safety precautions

The section "Safety precautions" under "Explanations on Technical Data" describes how the tube is to be protected against damage due to electric overload or insufficient cooling. A copper wire with 0,20 mm diameter should be used to test the anode overcurrent trip circuit.

Cooling air diagram



The cooling air is supplied from the electrode terminal side.

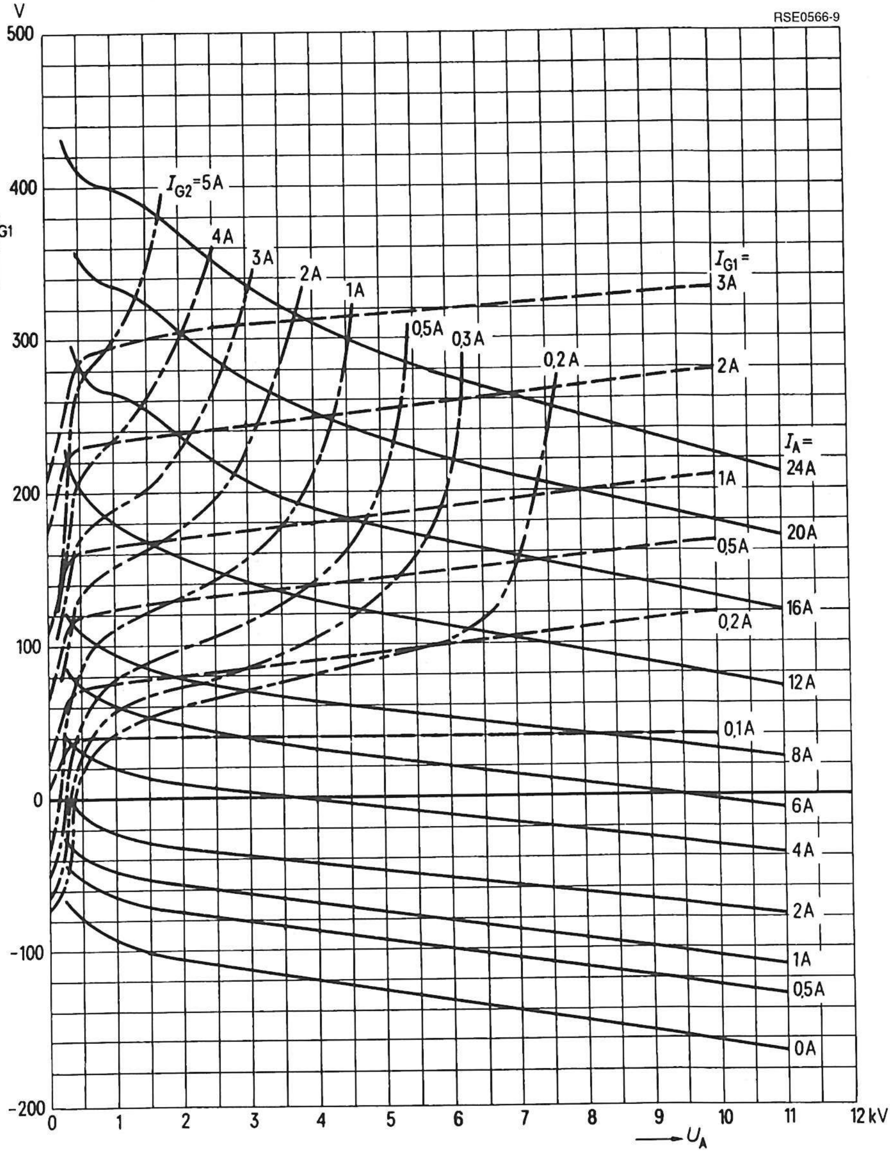
Air pressure = 1 bar

t_1 = 25 °C

VX

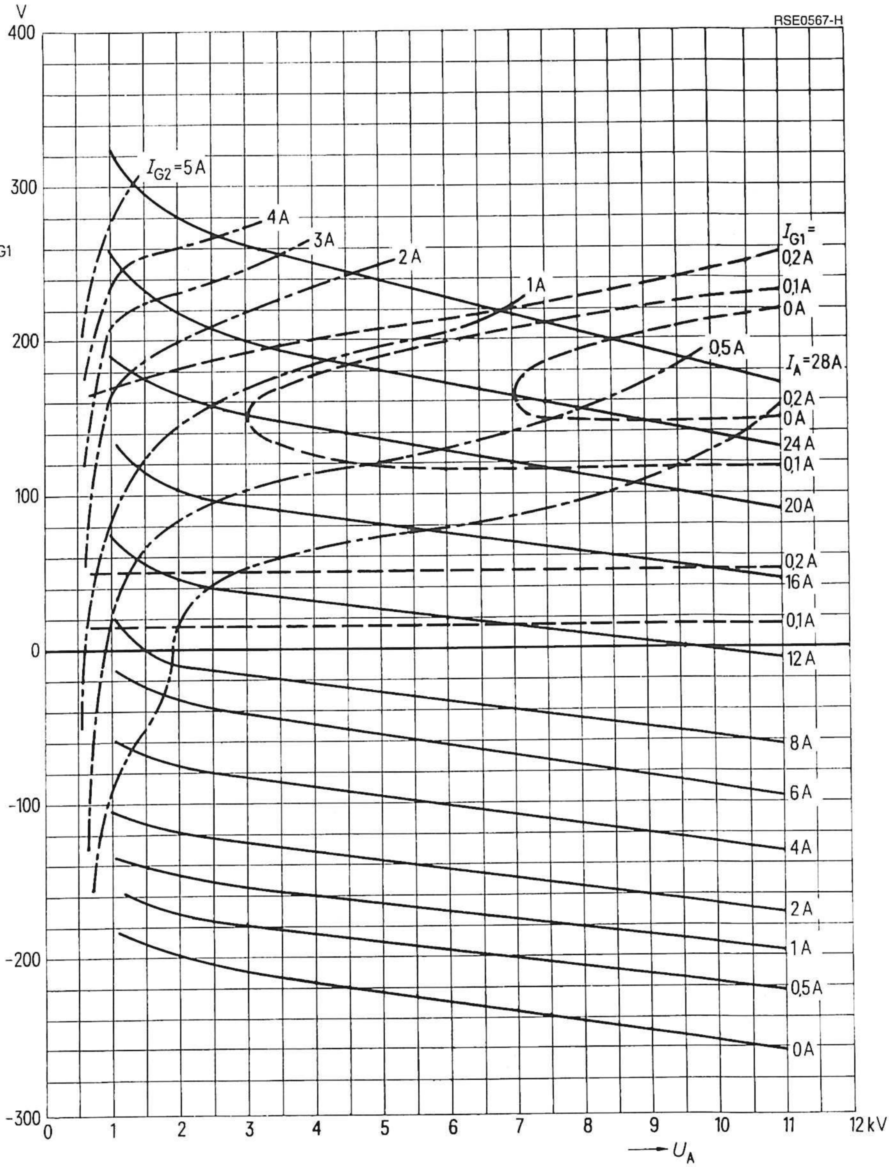
$U_{G1} = f(U_A)$
$U_{G2} = 400$ V

Parameter = I_A ————————
Parameter = I_{G2} —·—·—·—·—
Parameter = I_{G1} — — — — — —



$U_{G1} = f(U_A)$
$U_{G2} = 800$ V

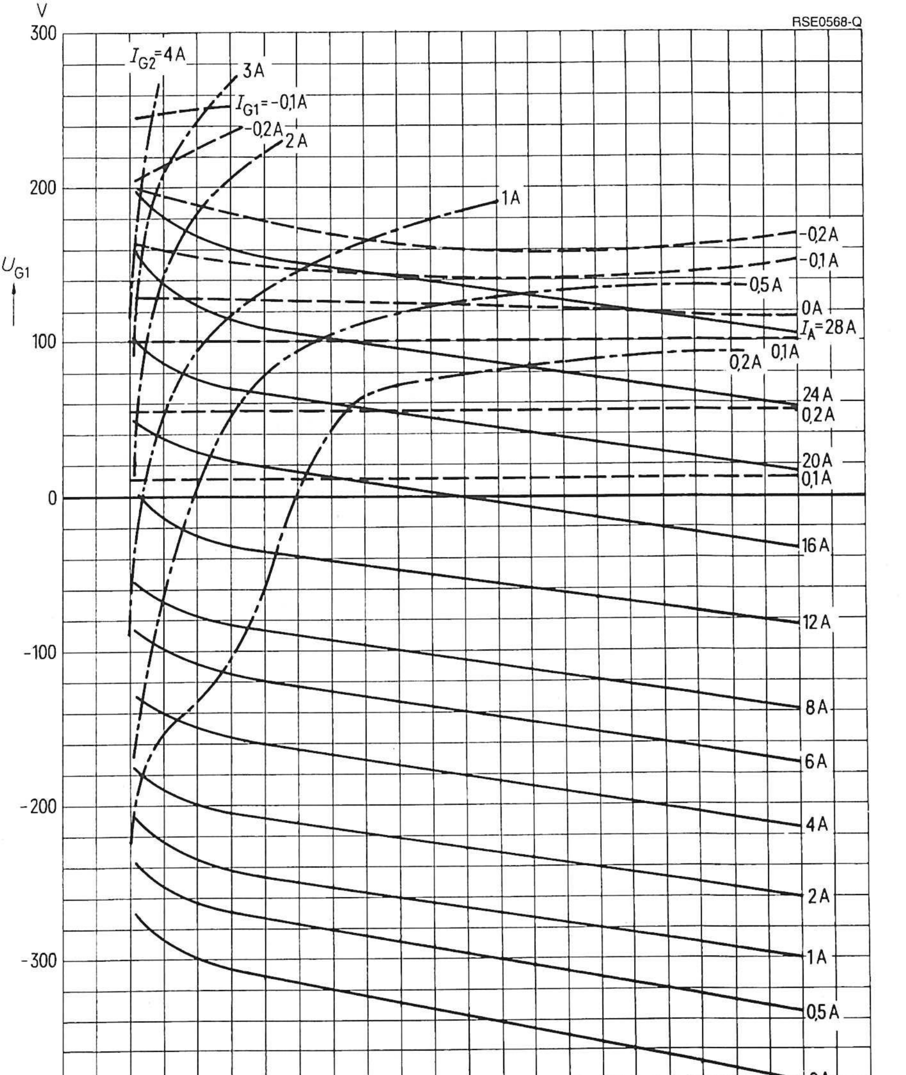
Parameter = I_A
Parameter = I_{G2}
Parameter = I_{G1}



VX

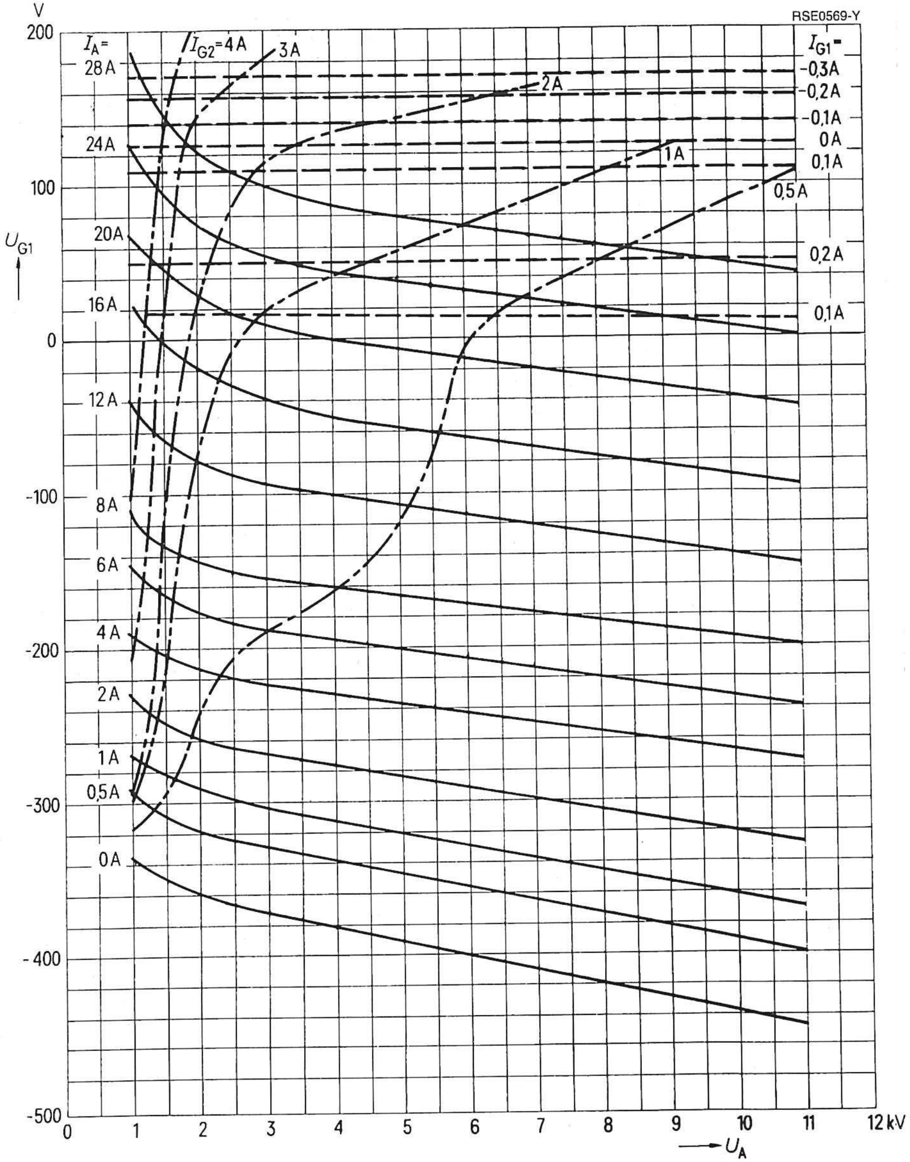
$U_{G1} = f(U_A)$
$U_{G2} = 1200$ V

Parameter = I_A ———
Parameter = I_{G2} —·—·—
Parameter = I_{G1} — — —



$U_{G1} = f(U_A)$
$U_{G2} = 1500$ V

Parameter = I_A ————
Parameter = I_{G2} —·—·—·—
Parameter = I_{G1} — — — —

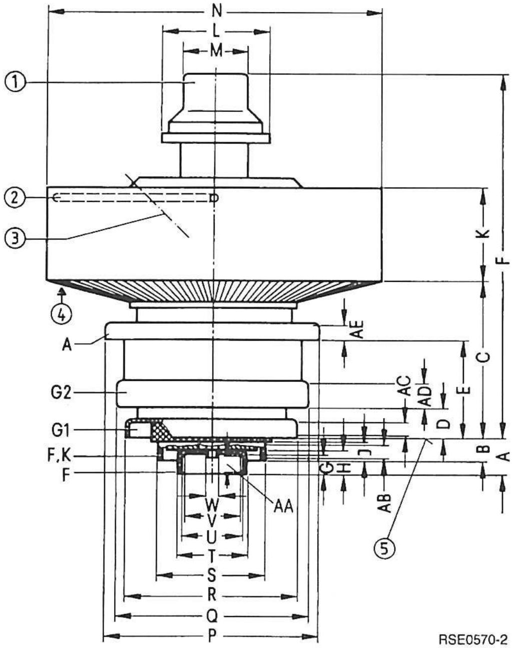


VX

For frequencies up to 1215 MHz Ordering code Q51-X1055

Coaxial metal-ceramic tetrode, forced-air-cooled.

The tube is suitable for the final stages of TV sound transmitters band III and TV translators band III to V. Its high amplification frequently permits driving by semiconductor stages.



Dimensional data

	min	max	
A	10,3	12,1	
B	6,4	7,8	
C	44	45,4	
D	8,1	9,7	
E	27,9	29,5	
F	99,8	103	
G	6,2		
H	6,8		
J	6,8		
K	30,8	33,2	
L		dia. 27	
M		dia. 22	
N	dia. 94,7	dia. 95,3	
P	dia. 59,8	dia. 60,2	
Q	dia. 53,6	dia. 54	
R	dia. 45,6	dia. 46,2	
S	dia. 29,9	dia. 30,1	
T	dia. 17,9	dia. 18,1	
U	dia. 16,5	dia. 16,9	
V	dia. 15,5		
W		dia. 5	
AA	5,2		⑥
AB	4,7		⑥
AC	2,7		⑥
AD	5,6		⑥
AE	3,7		⑥

Dimensions in mm

① Pump stem protecting cap, not be used as terminal
② Handle, swingable
③ Taphole for tube fuse RöSich2
④ Recommended direction of cooling air
⑤ Reference edge
⑥ For connection of the contact springs

Approx. weight 1,1 kg

Packing dimensions: approx. 310 mm × 310 mm × 320 mm.

Heating

Heater voltage	U_F	3,8 (± 5 %)	V [1]
Heater current	I_F	19,5 ± 2	A
Preheating time	t_h	≥ 3	min
Heating: indirect by ac or dc			
Cathode: matrix oxide			

Characteristics

Amplification factor of screen grid at U_A = 2,5 kV, U_{G2} = 500 V, I_A = 0,5 A	μ_{g2g1}	11	
Transconductance at U_A = 2,5 kV, U_{G2} = 500 V, I_A = 0,5 A	S	55	mA/V

Capacitances

		min	nom	max	
Cathode/control grid	c_{kg1}	38	42	46	pF
Cathode/screen grid	c_{kg2}	1,9	2,2	2,5	pF
Cathode/anode	c_{ka}		0,005	0,011	pF
Control grid/screen grid	c_{g1g2}	56	60	64	pF
Control grid/anode	c_{g1a}		0,05	0,06	pF
Screen grid/anode	c_{g2a}	7,5	8,0	8,8	pF

Accessories

		Ordering code
Tube fuse	RöSich2	Q81-X1402 [2]
Tube fuse	RöSich9	Q81-X1409 [2]
Socket wrench for tube fuse	RöZub10	Q81-X2110
Tube protective device	RöKt2	Q81-X1302
Pull switch for tube fuse	RöKt11	Q81-X1311
Cavity band III, 200 W vision/sound	TK4425	Q94-X4425
Cavity band IV/V, 200 W vision/sound	TK4435	Q94-X4435
Cavity band III, 800 W sound	TK4450	Q94-X4450
Spring-finger contact for anode terminal	YLZ9521a	Q81-X9204
Spring-finger contact for screen grid terminal	YLZ9521g2	Q81-X9205
Spring-finger contact for control grid terminal	YLZ9521g1	Q81-X9206
Spring-finger contact for heater cathode terminal	YLZ9523	Q81-X9523

1) For immediate operation, the tube can be continuously heated without damaging the cathode. The optimum heater voltage for standby operation is 3,5 to 3,8 V. The standby and operating times should be equal (e.g. 1 week operation, 1 week standby). Care should be taken not to exceed the maximum permissible surface temperature of 250 °C even during standby operation, especially without cooling.
2) RöSich2 (120 mm) and RöSich9 (25 mm) only differ in the length of the phosphor-bronze litz wire.

Maximum ratings

Frequency	f	860	MHz
Cold anode voltage (dc)	$U_{A\,0}$	3200	V
Anode voltage (dc)	U_A	3000	V
Screen grid voltage (dc)	U_{G2}	650	V
Control grid voltage (dc)	U_{G1}	– 100	V
Cathode current (dc)	I_K	800	mA
Output power	P_2	800	W
Anode dissipation	P_A	1,8	kW
Screen grid dissipation	P_{G2}	20	W
Control grid dissipation	P_{G1}	3	W
Surface temperature	t_{surf}	250	°C [1]

Operating characteristics for TV sound transmitters

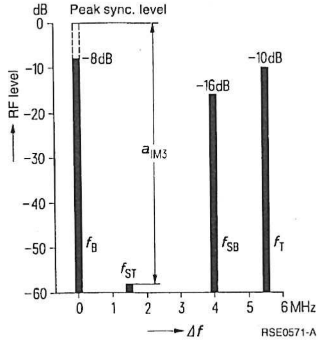
Frequency	f	170 ... 230	MHz
Bandwidth (3 dB)	B	2	MHz
Output power	P_2	800	W [2]
Power gain	V_p	≥ 19	dB
Anode voltage (dc)	U_A	2750	V
Screen grid voltage (dc)	U_{G2}	500	V
Zero signal anode current (dc)	$I_{A\,0}$	400	mA
Anode current (dc)	I_A	700	mA
Screen grid current (dc)	I_{G2}	10	mA [3]

1) See cooling.
2) Power at cavity output with ≥ 90 % circuit efficiency.
3) The power supply must be designed for a screen grid current of – 5 to + 40 mA.

Operating characteristics for TV translators with combined vision/sound transmission

Frequency	f	170…230	470…790	790…860	MHz
Bandwidth (1 dB)	B	8,5	8,5	8,5	MHz
Output power, sync. level	$P_{2\,SY}$	220	220	220	W [1])
Power gain	V_p	≥ 16,5	≥ 16,5	≥ 16	dB
3-tone intermodulation ratio	a_{IM3}	≥ 58	≥ 58	≥ 58	dB [2])
Anode voltage (dc)	U_A	2500	2500	2750	V
Screen grid voltage (dc)	U_{G2}	500	500	500	V
Zero signal anode current (dc)	$I_{A\,0}$	400	400	350	mA
Anode current (dc), black level	$I_{A\,SW}$	500	500	450	mA
Screen grid current (dc)	I_{G2}	10	10	10	mA [3])

Level diagram



1) Power at cavity output with 85 % circuit efficiency.
2) Measured in accordance with specification FTZ 176 Pfl 2 of the German Telekom with distortion-free input signal; f_B: – 8 dB, f_{SB}: – 16 dB, f_T: – 10 dB.
3) The power supply must be designed for a screen grid current of – 5 to + 20 mA.

Tube mounting

Sufficiently flexible spring-finger contacts must be used to connect the tube. Suitable contact rings are available as accessories. The reference edge (control grid terminal, see dimensional drawing) also serves as stop edge.

If the tube is to be clamped to the socket in order to prevent it from jumping out of the latter, the clamping pressure may only have an effect on the stop edge.

The tube can be mounted as required.

Recommendations on power supply dimensioning for linear amplifiers

For the generation of the control grid voltage we recommend a constant voltage source since the linearity of performance deteriorates if a cathode resistor is used.

At drive with modulated signal, a rectifying effect is produced by the quadratic component of the tube transfer characteristic and the anode or cathode current contains video frequency components with frequencies up to 5,5 MHz. Therefore, the cathode/grid path as well as the anode power supply must be sufficiently blocked and free of resonances for the entire video frequency range to prevent reactive effects on the intermodulation of the amplifier. Experience has shown that an electrolytic capacitor of 10 µF to 50 µF is necessary between control grid and cathode. For screen grid and anode power supply a capacitor of 0,1 µF up to some µF is recommended.

Forced-air cooling

The minimum air flow rate required for max. anode dissipation is given in the cooling air diagram, valid for 45 °C inlet temperature at a normal air pressure of 1 bar (sea level). The cooling air is supplied from the electrode terminal side. For further details on forced-alr cooling refer to "Explanations on Technical Data".

Safety precautions

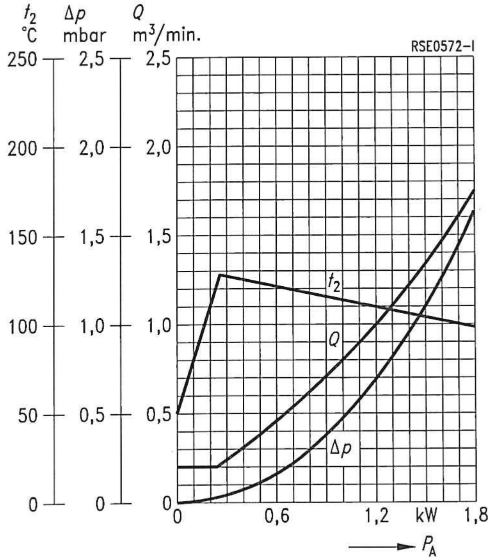
The section "Safety precautions" under "Explanations on Technical Data" describes how the tube is to be protected against damage due to electric overload or insufficient cooling. A copper wire with 0,10 mm diameter should be used to test the anode overcurrent trip circuit.

The use of a tube fuse RöSich2/RöSich9 is recommended to protect the anode against thermal overload. In conjunction with a pull switch RöKt11 it disconnects the voltages at the tube in case of overload (see accessories).

A protective gap shall be provided between screen grid and cathode to protect the control grid and the cathode against damage in case of spark-over from the side of the anode.

In addition, a limiting circuitry is recommended for screen grid protection.

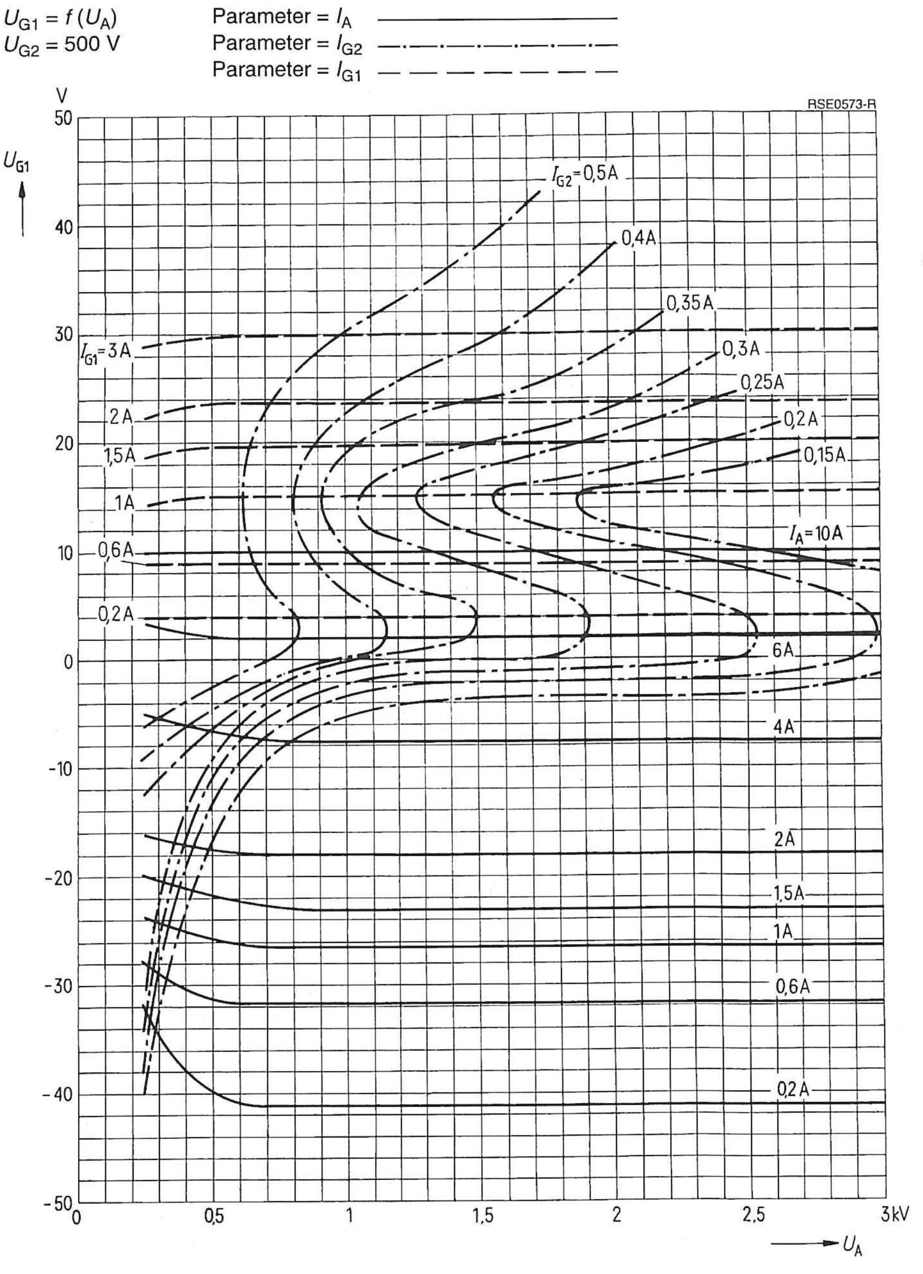
Cooling air diagram



The cooling air is supplied from the electrode terminal side.

Air pressure = 1 bar

t_1 = 45 °C



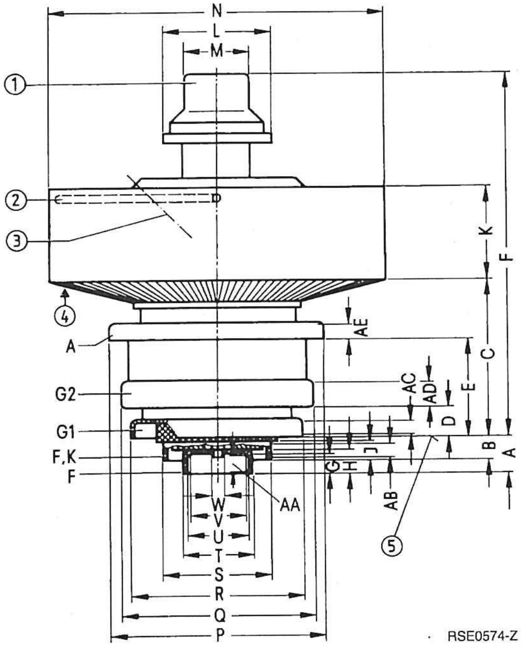
$U_{G1} = f(U_A)$
$U_{G2} = 500$ V
Parameter = I_A
Parameter = I_{G2}
Parameter = I_{G1}
RSE0573-R
V
U_{G1}
50
40
30
20
10
0
-10
-20
-30
-40
-50
0
0,5
1
1,5
2
2,5
3kV
U_A
I_{G2}=0,5A
0,4A
0,35A
0,3A
0,25A
0,2A
0,15A
I_{G1}=3A
2A
1,5A
1A
0,6A
0,2A
I_A=10A
6A
4A
2A
1,5A
1A
0,6A
0,2A

For frequencies up to 1215 MHz

Ordering code Q51-X1056

Coaxial metal-ceramic tetrode, forced-air-cooled.

The tube is suitable for power amplifiers, in particular for the final stages of TV vision and sound transmitters as well as TV translators. It features especially close tolerance characteristics and high amplification.



Dimensional data

	min	max	
A	10,3	12,1	
B	6,4	7,8	
C	44	45,4	
D	8,1	9,7	
E	27,9	29,5	
F	99,8	103	
G	6,2		
H	6,8		
J	6,8		
K	30,8	33,2	
L		dia. 27	
M		dia. 22	
N	dia. 94,7	dia. 95,3	
P	dia. 59,8	dia. 60,2	
Q	dia. 53,6	dia. 54	
R	dia. 45,6	dia. 46,2	
S	dia. 29,9	dia. 30,1	
T	dia. 17,9	dia. 18,1	
U	dia. 16,5	dia. 16,9	
V	dia. 15,5		
W		dia. 5	
AA	5,2		⑥
AB	4,7		⑥
AC	2,7		⑥
AD	5,6		⑥
AE	3,7		⑥

Dimensions in mm

① Pump stem protecting cap, not be used as terminal
② Handle, swingable
③ Taphole for tube fuse RöSich2
④ Recommended direction of cooling air
⑤ Reference edge
⑥ For connection of the contact springs

Approx. weight 1,1 kg

Packing dimensions: approx. 310 mm × 310 mm × 320 mm.

Heating

Heater voltage	U_F	3,8 (± 5 %)	V [1]
Heater current	I_F	19,5 ± 2	A
Preheating time	t_h	≥ 3	min
Heating: indirect by ac or dc			
Cathode: matrix oxide			

Characteristics

Amplification factor of screen grid at U_A = 3 kV, U_{G2} = 500 V, I_A = 0,5 A	μ_{g2g1}	11	
Transconductance at U_A = 3 kV, U_{G2} = 500 V, I_A = 0,5 A	s	55	mA/V

Capacitances

		min	nom	max	
Cathode/control grid	c_{kg1}	38	42	46	pF
Cathode/screen grid	c_{kg2}	1,9	2,2	2,5	pF
Cathode/anode	c_{ka}		0,005	0,011	pF
Control grid/screen grid	c_{g1g2}	56	60	64	pF
Control grid/anode	c_{g1a}		0,05	0,06	pF
Screen grid/anode	c_{g2a}	7,5	8,0	8,8	pF

Accessories

		Ordering code
Tube fuse	RöSich2	Q81-X1402 [2]
Tube fuse	RöSich9	Q81-X1409 [2]
Socket wrench for tube fuse	RöZub10	Q81-X2110
Tube protective device	RöKt2	Q81-X1302
Pull switch for tube fuse	RöKt11	Q81-X1311
Cavity band III, 500 W vision/sound	TK4425	Q94-X4425
Cavity band IV/V, 500 W vision/sound	TK4435	Q94-X4435
Cavity band III, 1 kW vision	TK4441	Q94-X4441
Cavity band III, 1,1 kW sound	TK4450	Q94-X4450
Cavity band III, 1,7 kW sound	TK4451	Q94-X4451
Spring-finger contact for anode terminal	YLZ9521a	Q81-X9204
Spring-finger contact for screen grid terminal	YLZ9521g2	Q81-X9205
Spring-finger contact for control grid terminal	YLZ9521g1	Q81-X9206
Spring-finger contact for heater cathode terminal	YLZ9523	Q81-X9523

1) For immediate operation, the tube can be continuously heated without damaging the cathode. The optimum heater voltage for standby operation is 3,5 to 3,8 V. The standby and operating times should be equal (e.g. 1 week operation, 1 week standby). Care should be taken not to exceed the maximum permissible surface temperature of 250 °C even during standby operation, especially without cooling.
2) RöSich2 (120 mm) and RöSich9 (25 mm) only differ in the length of the phosphor-bronze litz wire.

Maximum ratings

Cold anode voltage (dc)	$U_{A\,0}$	3700	V
Anode voltage (dc)	U_A	3500	V
Screen grid voltage (dc)	U_{G2}	650	V
Control grid voltage (dc)	U_{G1}	– 100	V
Cathode current (dc)	I_K	1,1	A
Anode input power	$P_{B\,A}$	3,3	kW
Anode dissipation	P_A	2,0	kW
Screen grid dissipation	P_{G2}	30	W
Control grid dissipation	P_{G1}	5,0	W
Surface temperature	t_{surf}	250	°C 1)

Operating characteristics for TV vision transmitters

Frequency	f	170 … 230	MHz
Bandwidth (1 dB)	B	6,0	MHz
Output power, sync. level	$P_{2\,SY}$	1,0	kW 2)
Power gain	V_p	≥ 18,5	dB
Anode voltage (dc)	U_A	2400	V
Screen grid voltage (dc)	U_{G2}	500	V
Zero signal anode current (dc)	$I_{A\,0}$	800	mA
Anode current (dc), black level	$I_{A\,SW}$	1000	mA
Screen grid current (dc)	I_{G2}	25	mA 3)

Operating characteristics for TV sound transmitters

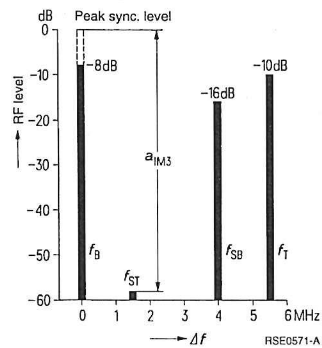
Frequency	f	170 … 230	MHz
Bandwidth (3 dB)	B	3,0	MHz
Output power	P_2	1,7	kW 2)
Power gain	V_p	≥ 19	dB
Anode voltage (dc)	U_A	3400	V
Screen grid voltage (dc)	U_{G2}	600	V
Zero signal anode current (dc)	$I_{A\,0}$	300	mA
Anode current (dc)	I_A	800	mA
Screen grid current (dc)	I_{G2}	22	mA 3)

1) See cooling.
2) Power at cavity output with ≥ 90 % circuit efficiency.
3) The power supply must be designed for a screen grid current of – 5 to + 50 mA.

Operating characteristics for TV translators with combined vision/sound transmission

Frequency	f	170 ... 230	470 ... 600	600 ... 860	MHz
Bandwidth (1 dB)	B	8,5	8,5	8,5	MHz
Output power, sync. level	$P_{2\,SY}$	550	550	550	W [1])
Power gain	V_p	≥ 17,5	≥ 17,5	≥ 17,5	dB
3-tone intermodulation ratio	a_{IM3}	≥ 58	≥ 58	≥ 58	dB [2])
Anode voltage (dc)	U_A	2,75	3,0	3,4	kV
Screen grid voltage (dc)	U_{G2}	600	600	600	V
Zero signal anode current (dc)	$I_{A\,0}$	570	570	500	mA
Anode current (dc), black level	$I_{A\,SW}$	700	700	650	mA
Screen grid current (dc)	I_{G2}	10	10	10	mA [3])

Level diagram



1) Power at cavity output with 85 % circuit efficiency.
2) Measured in accordance with specification FTZ 176 Pfl 2 of the German Telekom with distortion-free input signal; f_B: – 8 dB, f_{SB}: – 16 dB, f_T: – 10 dB.
3) The power supply must be designed for a screen grid current of – 5 to + 40 mA.

Tube mounting

Sufficiently flexible spring-finger contacts must be used to connect the tube. Suitable contact rings are available as accessories. The reference edge (control grid terminal, see dimensional drawing) also serves as stop edge.

If the tube is to be clamped to the socket in order to prevent it from jumping out of the latter, the clamping pressure may only have an effect on the stop edge.

The tube can be mounted as required.

Recommendations on power supply dimensioning for linear amplifiers

For the generation of the control grid voltage we recommend a constant voltage source since the linearity of performance deteriorates if a cathode resistor is used.

At drive with modulated signal, a rectifying effect is produced by the quadratic component of the tube transfer characteristic and the anode or cathode current contains video frequency components with frequencies up to 5,5 MHz. Therefore, the cathode/grid path as well as the anode power supply must be sufficiently blocked and free of resonances for the entire video frequency range to prevent reactive effects on the intermodulation of the amplifier. Experience has shown that an electrolytic capacitor of 10 μF to 50 μF is necessary between control grid and cathode. For screen grid and anode power supply a capacitor of 0,1 μF up to some μF is recommended.

Forced-air cooling

The minimum air flow rate required for max. anode dissipation is given in the cooling air diagram, valid for 45 °C inlet temperature at a normal air pressure of 1 bar (sea level). The cooling air is supplied from the electrode terminal side. For further details on forced-alr cooling refer to "Explanations on Technical Data".

Safety precautions

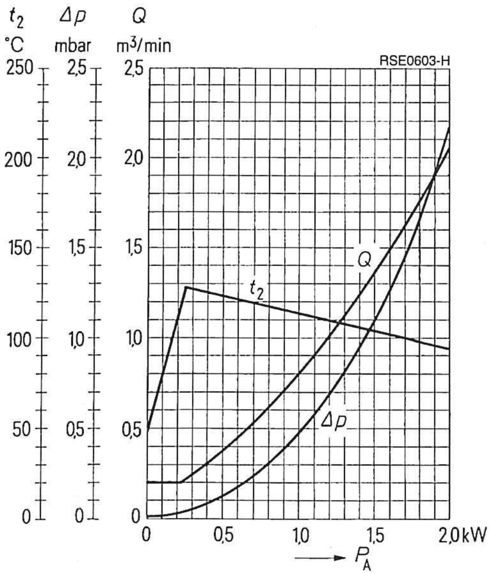
The section "Safety precautions" under "Explanations on Technical Data" describes how the tube is to be protected against damage due to electric overload or insufficient cooling. A copper wire with 0,10 mm diameter should be used to test the anode overcurrent trip circuit.

The use of a tube fuse RöSich2/RöSich9 is recommended to protect the anode against thermal overload. In conjunction with a pull switch RöKt11 it disconnects the voltages at the tube in case of overload (see accessories).

A protective gap shall be provided between screen grid and cathode to protect the control grid and the cathode against damage in case of spark-over from the side of the anode.

In addition, a limiting circuitry is recommended for screen grid protection.

Cooling air diagram

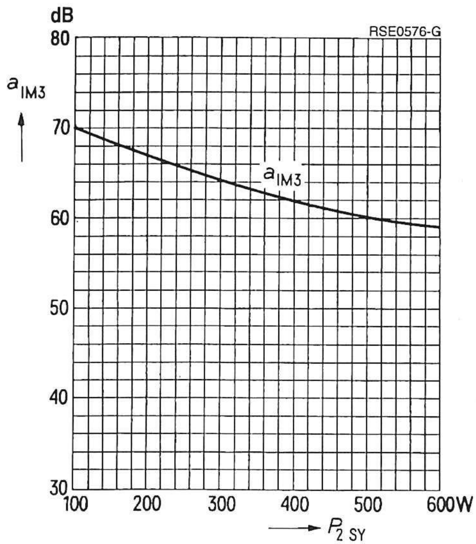


The cooling air is supplied from the electrode terminal side.

Air pressure = 1 bar

t_1 = 45 °C

3-ton intermodulation ratio $a_{IM3} = f(P_{2\,SY})$



U_A = 3,4 kV

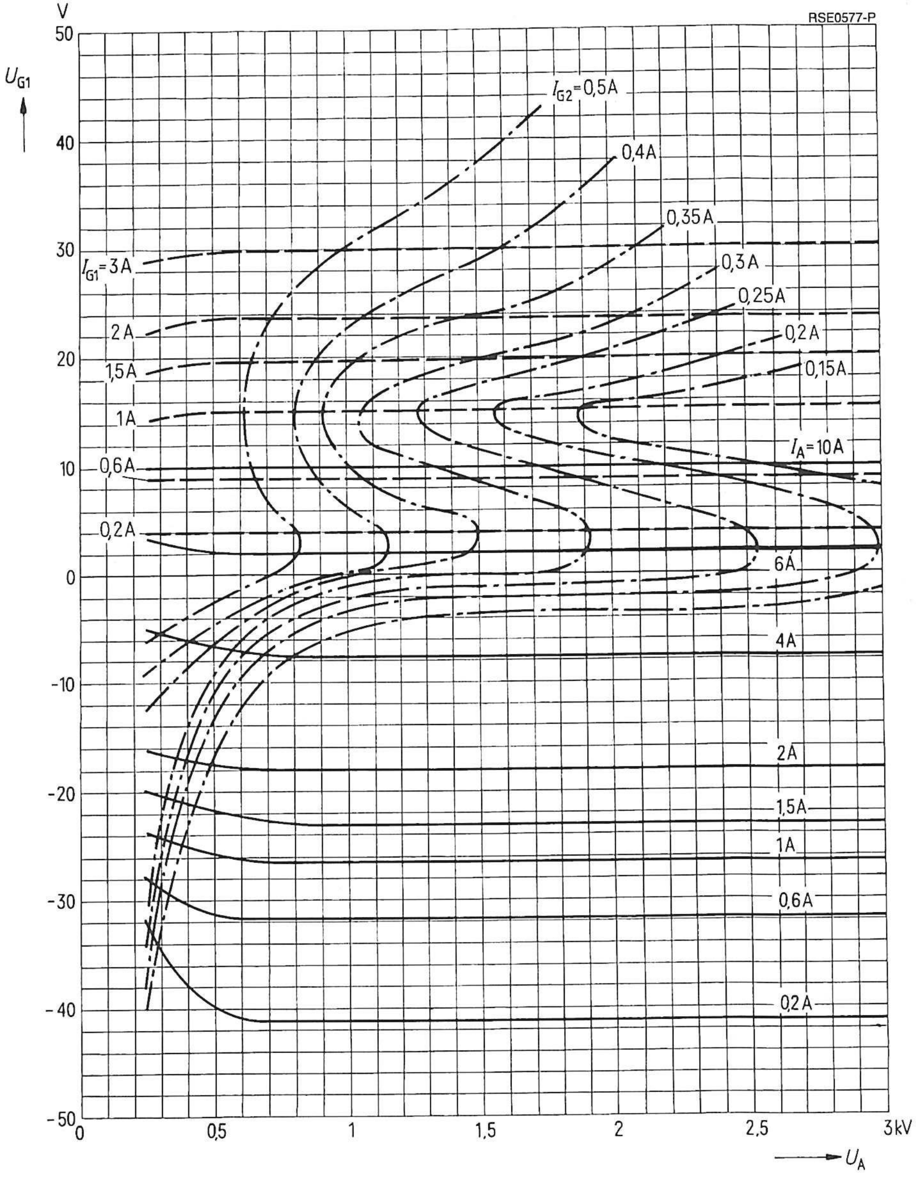
U_{G2} = 600 V

U_F = 3,8 V

B (1 dB) = 8,5 MHz

f = 780 MHz

$U_{G1} = f(U_A)$ Parameter = I_A ————
$U_{G2} = 500$ V Parameter = I_{G2} —·—·—·—
Parameter = I_{G1} — — — —

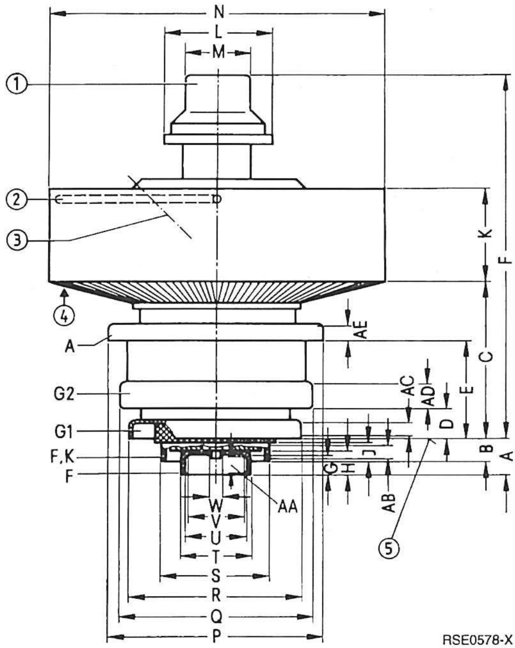


VX

For frequencies up to 1215 MHz Ordering code Q51-X1057

Coaxial metal-ceramic tetrode, forced-air-cooled.

The tube is suitable for power amplifiers up to 2,3 kW, in particular for the final stages of TV vision and sound transmitters as well as TV translators. It features especially close tolerance characteristics and high amplification.



Dimensional data

	min	max	
A	10,3	12,1	
B	6,4	7,8	
C	44	45,4	
D	8,1	9,7	
E	27,9	29,5	
F	99,8	103	
G	6,2		
H	6,8		
J	6,8		
K	30,8	33,2	
L		dia. 27	
M		dia. 22	
N	dia. 94,7	dia. 95,3	
P	dia. 59,8	dia. 60,2	
Q	dia. 53,6	dia. 54	
R	dia. 45,6	dia. 46,2	
S	dia. 29,9	dia. 30,1	
T	dia. 17,9	dia. 18,1	
U	dia. 16,5	dia. 16,9	
V	dia. 15,5		
W		dia. 5	
AA	5,2		⑥
AB	4,7		⑥
AC	2,7		⑥
AD	5,6		⑥
AE	3,7		⑥

Dimensions in mm

① Pump stem protecting cap, not be used as terminal
② Handle, swingable
③ Taphole for tube fuse RöSich2
④ Recommended direction of cooling air
⑤ Reference edge
⑥ For connection of the contact springs

Approx. weight 1,1 kg

Packing dimensions: approx. 310 mm × 310 mm × 320 mm.

Heating

Heater voltage	U_F	3,8 (± 5 %)	V [1]
Heater current	I_F	19,5 ± 2	A
Preheating time	t_h	≥ 3	min
Heating: indirect by ac or dc			
Cathode: matrix oxide			

Characteristics

Amplification factor of screen grid at U_A = 3 kV, U_{G2} = 500 V, I_A = 0,5 A	μ_{g2g1}	11	
Transconductance at U_A = 3 kV, U_{G2} = 500 V, I_A = 0,5 A	s	55	mA/V

Capacitances

		min	nom	max	
Cathode/control grid	c_{kg1}	38	42	46	pF
Cathode/screen grid	c_{kg2}	1,9	2,2	2,5	pF
Cathode/anode	c_{ka}		0,005	0,011	pF
Control grid/screen grid	c_{g1g2}	56	60	64	pF
Control grid/anode	c_{g1a}		0,05	0,06	pF
Screen grid/anode	c_{g2a}	7,5	8,2	8,8	pF

Accessories

		Ordering code
Tube fuse	RöSich2	Q81-X1402 [2]
Tube fuse	RöSich9	Q81-X1409 [2]
Socket wrench for tube fuse	RöZub10	Q81-X2110
Tube protective device	RöKt2	Q81-X1302
Pull switch for tube fuse	RöKt11	Q81-X1311
Cavity band IV/V, 1,1 kW vision/sound	TK4435	Q94-X4435
Cavity band IV/V, 1,3 kW sound, 400 W vision	TK4436	Q94-X4436
Cavity band III, 2,2 kW sound	TK4451	Q94-X4451
Spring-finger contact for anode terminal	YLZ9521a	Q81-X9204
Spring-finger contact for screen grid terminal	YLZ9521g2	Q81-X9205
Spring-finger contact for control grid terminal	YLZ9521g1	Q81-X9206
Spring-finger contact for heater cathode terminal	YLZ9523	Q81-X9523

1) For immediate operation, the tube can be continuously heated without damaging the cathode. The optimum heater voltage for standby operation is 3,5 to 3,8 V. The standby and operating times should be equal (e.g. 1 week operation, 1 week standby). Care should be taken not to exceed the maximum permissible surface temperature of 250 °C even during standby operation, especially without cooling.
2) RöSich2 (120 mm) and RöSich9 (25 mm) only differ in the length of the phosphor-bronze litz wire.

Maximum ratings

Cold anode voltage (dc)	(band III)	$U_{A\,0}$	4200	V
Cold anode voltage (dc)	(band IV/V)	$U_{A\,0}$	3800	V
Anode voltage (dc)	(band III)	U_A	4000	V
Anode voltage (dc)	(band IV/V)	U_A	3600	V
Screen grid voltage (dc)		U_{G2}	650	V
Control grid voltage (dc)		U_{G1}	– 100	V
Cathode current (dc)		I_K	1,2	A
Anode input power		$P_{B\,A}$	4,0	kW
Anode dissipation		P_A	2,0	kW
Screen grid dissipation		P_{G2}	30	W
Control grid dissipation		P_{G1}	5,0	W
Surface temperature		t_{surf}	250	°C [1]

Operating characteristics for TV sound transmitters

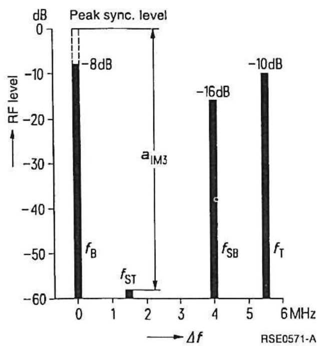
Frequency	f	170…230	470…600	600…860	MHz
Bandwidth (3 dB)	B	2,0	4,0	6,0	MHz
Output power	P_2	2,2	1,3	1,3	kW [2]
Power gain	V_p	≥19	≥ 19	≥ 17,5	dB
Anode voltage (dc)	U_A	3900	3200	3400	V
Screen grid voltage (dc)	U_{G2}	600	600	600	V
Zero signal anode current (dc)	$I_{A\,0}$	250	450	450	mA
Anode current (dc)	I_A	1000	800	900	mA
Screen grid current (dc)	I_{G2}	28	18	22	mA [3]

1) See cooling.
2) Power at cavity output with ≥ 90 % circuit efficiency.
3) The power supply must be designed for a screen grid current of – 1 to + 50 mA.

Operating characteristics for TV translators with combined vision/sound transmission

Frequency	f	470…600	600…860	MHz
Bandwidth (1 dB)	B	8,5	8,5	MHz
Output power, sync. level	$P_{2\,SY}$	1,1	1,1	kW 1)
Power gain	V_p	≥ 17	≥ 16,5	dB
3-tone intermodulation ratio	a_{IM3}	≥ 50	≥ 47	dB 2)
Anode voltage	U_A	3400	3400	V
Screen grid voltage	U_{G2}	600	600	V
Zero signal anode current	$I_{A\,0}$	550	500	mA
Anode current, black level	$I_{A\,SW}$	800	750	mA
Screen grid current	I_{G2}	15	15	mA 3)

Level diagram



1) Power at cavity output with ≥ 85 % circuit efficiency.
2) Measured in accordance with specification FTZ 176 Pfl 2 of the German Telekom with distortion-free input signal; f_B: – 8 dB, f_{SB}: – 16 dB, f_T: – 10 dB.
3) The power supply must be designed for a screen grid current of – 5 to + 40 mA.

Tube mounting

Sufficiently flexible spring-finger contacts must be used to connect the tube. Suitable contact rings are available as accessories. The reference edge (control grid terminal, see dimensional drawing) also serves as stop edge.

If the tube is to be clamped to the socket in order to prevent it from jumping out of the latter, the clamping pressure may only have an effect on the stop edge.

The tube can be mounted as required.

Recommendations on power supply dimensioning for linear amplifiers

For the generation of the control grid voltage we recommend a constant voltage source since the linearity of performance deteriorates if a cathode resistor is used.

At drive with modulated signal, a rectifying effect is produced by the quadratic component of the tube transfer characteristic and the anode or cathode current contains video frequency components with frequencies up to 5,5 MHz. Therefore, the cathode/grid path as well as the anode power supply must be sufficiently blocked and free of resonances for the entire video frequency range to prevent reactive effects on the intermodulation of the amplifier. Experience has shown that an electrolytic capacitor of 10 µF to 50 µF is necessary between control grid and cathode. For screen grid and anode power supply a capacitor of 0,1 µF up to some µF is recommended.

Forced-air cooling

The minimum air flow rate required for max. anode dissipation is given in the cooling air diagram, valid for 45 °C inlet temperature at a normal air pressure of 1 bar (sea level). The cooling air is supplied from the electrode terminal side. For further details on forced-alr cooling refer to “Explanations on Technical Data”.

Safety precautions

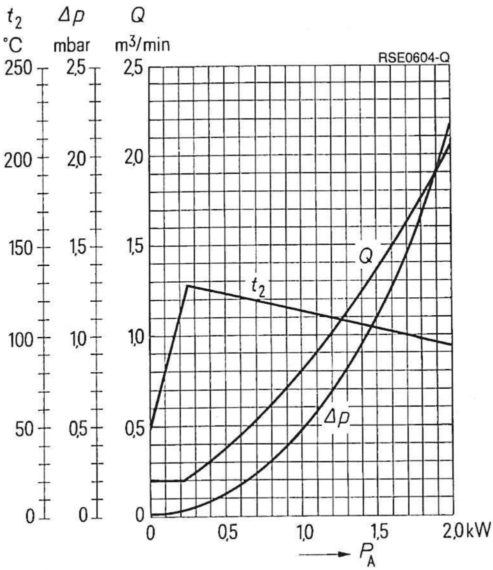
The section “Safety precautions” under “Explanations on Technical Data” describes how the tube is to be protected against damage due to electric overload or insufficient cooling. A copper wire with 0,12 mm diameter should be used to test the anode overcurrent trip circuit.

The use of a tube fuse RöSich2/RöSich9 is recommended to protect the anode against thermal overload. In conjunction with a pull switch RöKt11 it disconnects the voltages at the tube in case of overload (see accessories).

A protective gap shall be provided between screen grid and cathode to protect the control grid and the cathode against damage in case of spark-over from the side of the anode.

In addition, a limiting circuitry is recommended for screen grid protection.

Cooling air diagram

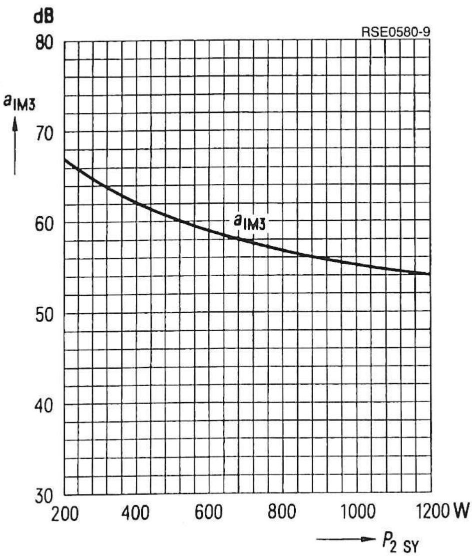


The cooling air is supplied from the electrode terminal side.

Air pressure = 1 bar

t_1 = 45 °C

3-ton intermodulation ratio $a_{IM3} = f\,(P_{2\,SY})$

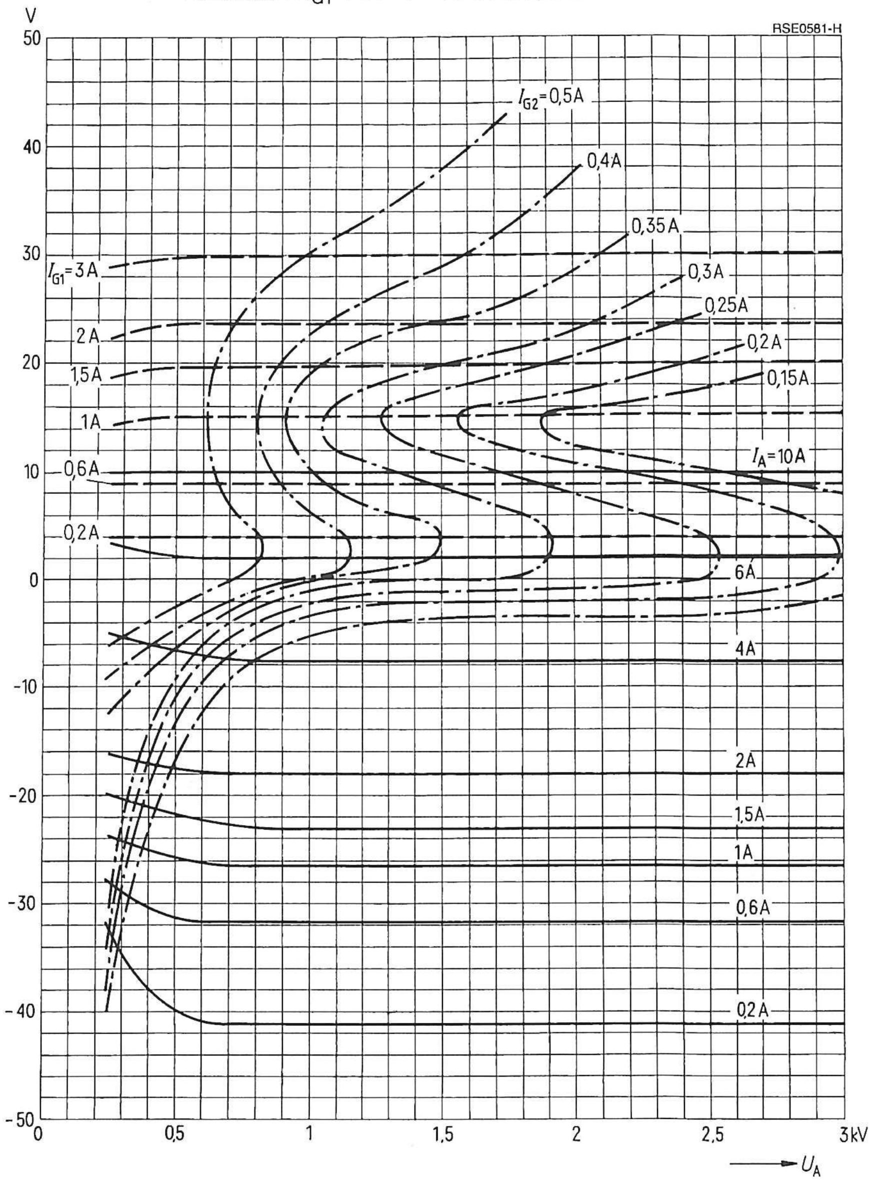


U_A = 3,4 kV
U_{G2} = 600 V
U_F = 3,8 V
B (1 dB) = 8,5 MHz
f = 780 MHz

VX

$U_{G1} = f(U_A)$
$U_{G2} = 500$ V

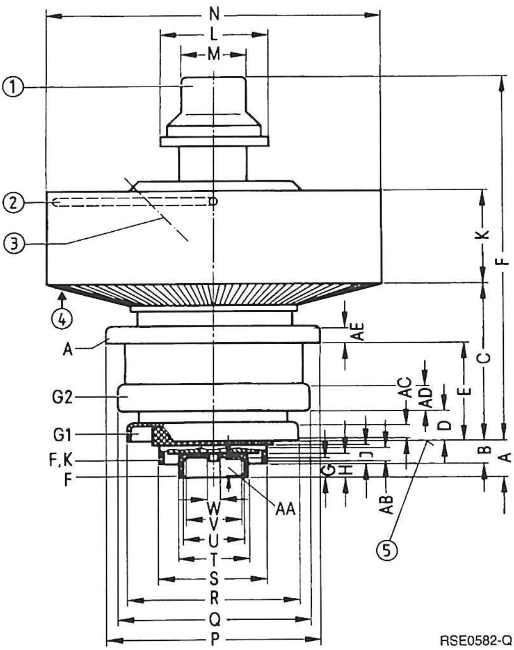
Parameter = I_A ————————
Parameter = I_{G2} —·—·—·—·—
Parameter = I_{G1} — — — — — —



For frequencies up to 1215 MHz Ordering code Q51-X1058

Coaxial metal-ceramic tetrode, forced-air-cooled.

The tube is suitable for power amplifiers, in particular for the final stages of TV sound transmitters (two tone). It features especially close tolerance characteristics and high amplification.



Dimensional data

	min	max	
A	10,3	12,1	
B	6,4	7,8	
C	44	45,4	
D	8,1	9,7	
E	27,9	29,5	
F	99,8	103	
G	6,2		
H	6,8		
J	6,8		
K	30,8	33,2	
L		dia. 27	
M		dia. 22	
N	dia. 94,7	dia. 95,3	
P	dia. 59,8	dia. 60,2	
Q	dia. 53,6	dia. 54	
R	dia. 45,6	dia. 46,2	
S	dia. 29,9	dia. 30,1	
T	dia. 17,9	dia. 18,1	
U	dia. 16,5	dia. 16,9	
V	dia. 15,5		
W		dia. 5	
AA	5,2		⑥
AB	4,7		⑥
AC	2,7		⑥
AD	5,6		⑥
AE	3,7		⑥

Dimensions in mm

① Pump stem protecting cap, not be used as terminal
② Handle, swingable
③ Taphole for tube fuse RöSich2
④ Recommended direction of cooling air
⑤ Reference edge
⑥ For connection of the contact springs

Approx. weight 1,1 kg

Packing dimensions: approx. 310 mm × 310 mm × 320 mm.

VX

Heating

Heater voltage	U_F	3,6 (± 5 %)	V [1]
Heater current	I_F	19,0 ± 2	A
Preheating time	t_h	≥ 3	min
Heating: indirect by ac or dc			
Cathode: matrix oxide			

Characteristics

Amplification factor of screen grid at U_A = 3 kV, U_{G2} = 500 V, I_A = 0,5 A	μ_{g2g1}	11	
Transconductance at U_A = 3 kV, U_{G2} = 500 V, I_A = 0,5 A	s	55	mA/V

Capacitances

		min	nom	max	
Cathode/control grid	c_{kg1}	38	42	46	pF
Cathode/screen grid	c_{kg2}	1,9	2,2	2,5	pF
Cathode/anode	c_{ka}		0,005	0,011	pF
Control grid/screen grid	c_{g1g2}	56	60	64	pF
Control grid/anode	c_{g1a}		0,05	0,06	pF
Screen grid/anode	c_{g2a}	7,5	8,0	8,8	pF

Accessories

		Ordering code
Tube fuse	RöSich2	Q81-X1402 [2]
Tube fuse	RöSich9	Q81-X1409 [2]
Socket wrench for tube fuse	RöZub10	Q81-X2110
Tube protective device	RöKt2	Q81-X1302
Pull switch for tube fuse	RöKt11	Q81-X1311
Cavity band IV/V, 0,84 + 0,17 kW two tone	TK4436	Q94-X4436
Cavity band III, 1,2 + 0,24 kW two tone	TK4451	Q94-X4451
Spring-finger contact for anode terminal	YLZ9521a	Q81-X9204
Spring-finger contact for screen grid terminal	YLZ9521g2	Q81-X9205
Spring-finger contact for control grid terminal	YLZ9521g1	Q81-X9206
Spring-finger contact for heater cathode terminal	YLZ9523	Q81-X9523

1) For immediate operation, the tube can be continuously heated without damaging the cathode. The optimum heater voltage for standby operation is 3,5 to 3,8 V. The standby and operating times should be equal (e.g. 1 week operation, 1 week standby). Care should be taken not to exceed the maximum permissible surface temperature of 250 °C even during standby operation, especially without cooling.

2) RöSich2 (120 mm) and RöSich9 (25 mm) only differ in the length of the phosphor-bronze litz wire.

Maximum ratings

Cold anode voltage (dc)	U_{A0}	3800	V
Anode voltage (dc)	U_A	3600	V
Screen grid voltage (dc)	U_{G2}	650	V
Control grid voltage (dc)	U_{G1}	– 100	V
Cathode current (dc)	I_K	1,2	A
Anode input power	P_{BA}	3,5	kW
Anode dissipation	P_A	2,2	kW
Screen grid dissipation	P_{G2}	30	W
Control grid dissipation	P_{G1}	5,0	W
Surface temperature	t_{surf}	250	°C [1]

Operating characteristics for TV sound transmitters (two tone)

Frequency	f	170 ... 230	470 ... 600	600 ... 860	MHz
Bandwidth (3 dB)	B	3,0	6,0	9,0	MHz
Ausgangsleistung	P_2	1,2+0,24 [2]	0,84+0,17 [3]	0,84+0,17 [3]	kW [4]
Output power	V_p	≥ 19	≥ 17	≥ 17	dB
Anode voltage (dc)	U_A	3400	3400	3400	V
Screen grid voltage (dc)	U_{G2}	600	600	600	V
Zero signal anode current (dc)	I_{A0}	400	450	430	mA
Anode current (dc)	I_A	900	950	950	mA
Screen grid current (dc)	I_{G2}	20	20	20	mA [5]

1) See cooling.
2) Power at cavity output with ≥ 90 % circuit efficiency. Corresponds to 1/0,2 kW after the vision/sound diplexer.
3) Power at cavity output with ≥ 85 % circuit efficiency. Corresponds to 0,5/0,1 kW after the vision/sound diplexer.
4) 242 kHz carrier spacing.
5) The power supply must be designed for a screen grid current of – 5 to + 50 mA.

Tube mounting

Sufficiently flexible spring-finger contacts must be used to connect the tube. Suitable contact rings are available as accessories. The reference edge (control grid terminal, see dimensional drawing) also serves as stop edge.

If the tube is to be clamped to the socket in order to prevent it from jumping out of the latter, the clamping pressure may only have an effect on the stop edge.

The tube can be mounted as required.

Forced-air cooling

The minimum air flow rate required for max. anode dissipation is given in the cooling air diagram, valid for 45 °C inlet temperature at a normal air pressure of 1 bar (sea level). The cooling air is supplied from the electrode terminal side. For further details on forced-alr cooling refer to "Explanations on Technical Data".

Safety precautions

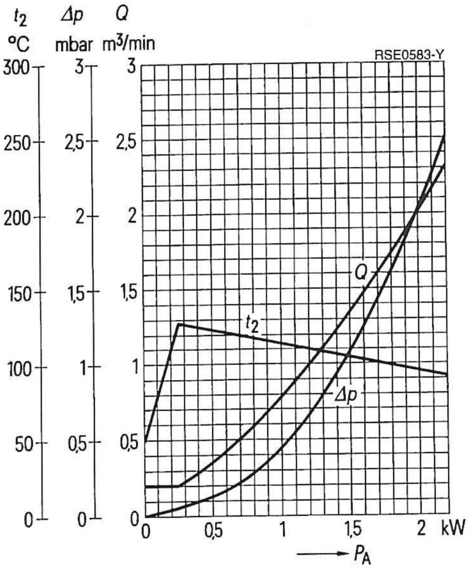
The section "Safety precautions" under "Explanations on Technical Data" describes how the tube is to be protected against damage due to electric overload or insufficient cooling. A copper wire with 0,12 mm diameter should be used to test the anode overcurrent trip circuit.

The use of a tube fuse RöSich2/RöSich9 is recommended to protect the anode against thermal overload. In conjunction with a pull switch RöKt11 it disconnects the voltages at the tube in case of overload (see accessories).

A protective gap shall be provided between screen grid and cathode to protect the control grid and the cathode against damage in case of spark-over from the side of the anode.

In addition, a limiting circuitry is recommended for screen grid protection.

Cooling air diagram



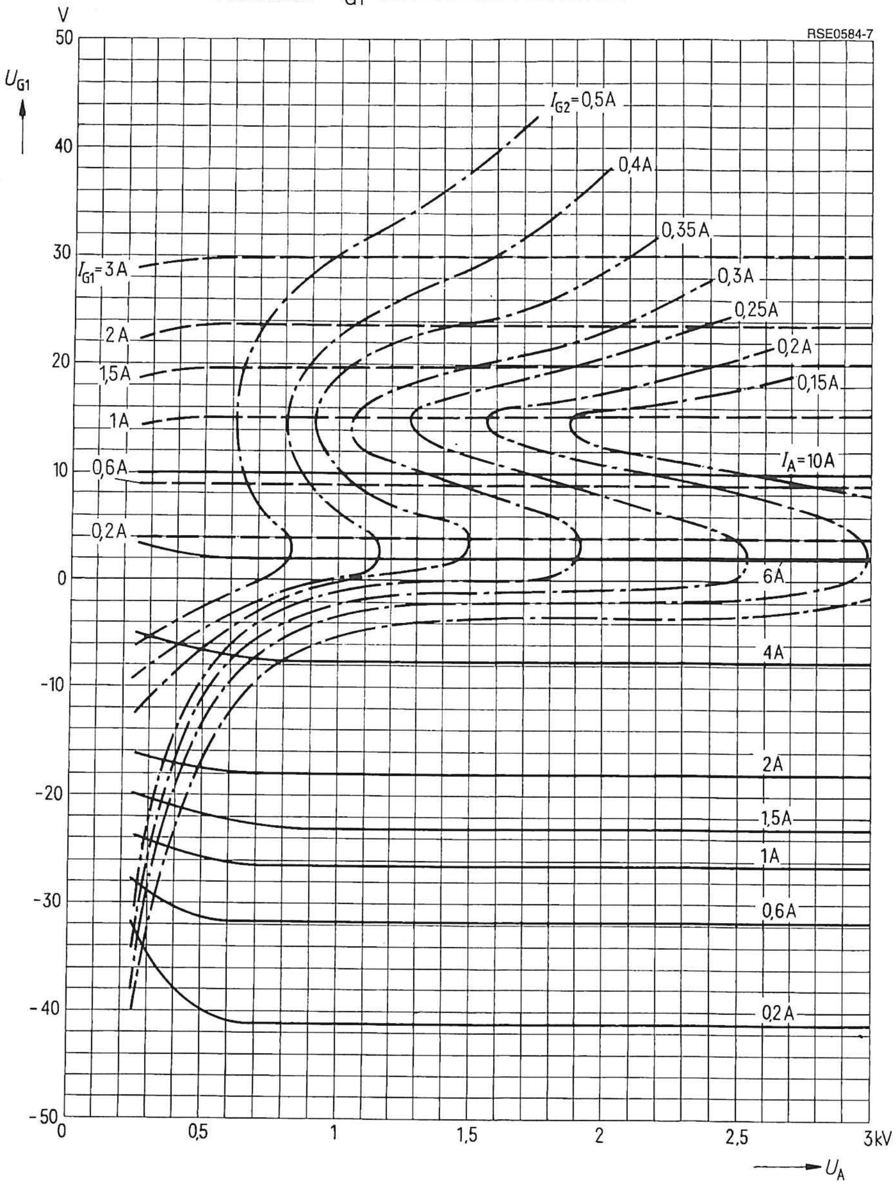
The cooling air is supplied from the electrode terminal side.

Air pressure = 1 bar

t_1 = 45 °C

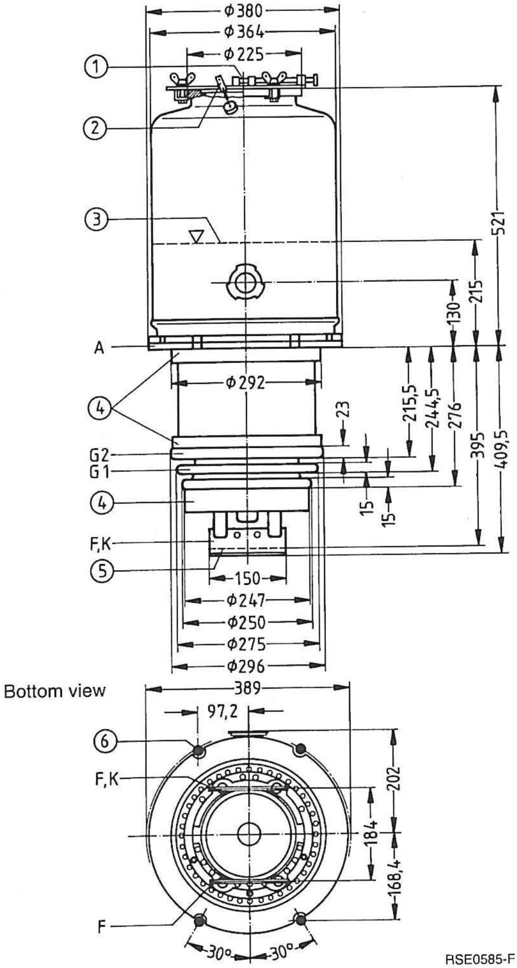
$U_{G1} = f(U_A)$
$U_{G2} = 500$ V

Parameter = I_A ————————
Parameter = I_{G2} —·—·—·—·—
Parameter = I_{G1} — — — — — —



Ordering code Q53-X1490

Coaxial metal-ceramic tetrode, vapor-cooled, with integrated boiler, particularly suitable for anode-modulated MW and SW transmitters up to 250 kW.



RSE0585-F

Dimensions in mm

① Crane suspension
② Terminal of tube fuse RöSich490
③ Max. water level
④ Do not use as terminal
⑤ Contact surface
⑥ Slide rods in the transmitter, 20 mm dia.

Approx. weight 120 kg

Heating

Heater voltage	U_F	7,2	V
Heater current	I_F	≈ 1025	A
Permissible starting current	$I_{F\,M}$	≤ 2500	A
Heating: direct			
Cathode: thoriated tungsten			

Characteristics

Emission current at $U_A = U_{G2} = U_{G1} = 700$ V	I_{em}	380	A
Amplification factor at $U_A = 5$ kV, $U_{G2} = 800$ to 1200 V, $I_A = 20$ A	μ	4,3	
Transconductance at $U_A = 5$ kV, $U_{G2} = 1200$ V, $I_A = 20$ A	s	200	mA/V

Capacitances

Cathode/control grid	c_{kg1}	≈ 460	pF
Cathode/screen grid	c_{kg2}	≈ 50	pF
Cathode/anode	c_{ka}	≈ 2	pF [1])
Control grid/screen grid	c_{g1g2}	≈ 440	pF
Control grid/anode	c_{g1a}	≈ 7	pF [1])
Screen grid/anode	c_{g2a}	≈ 170	pF

Accessories

Accessories		Ordering code
Cathode terminal	RöKat490	Q1001-X25
Control grid terminal	RöGit490	Q1001-X20
Screen grid terminal	RöGit491	Q1001-X19
Socket wrench for tube fuse	RöZub09	Q81-X2109
Pressure piece for water inlet	RöZub101	Q1001-X110
Locking piece for water inlet	RöZub102	Q1001-X111
Gasket ring for water inlet	RöZub103	C65055-A670-C503
Gasket ring for vapor outlet	RöZub104	C65055-A670-C504
Tube fuse	RöSich490	C65055-A870-A99
Pull switch for tube fuse	RöKt11	Q81-X1311
LL anti-electrolytic coupling (250 kW)	RöEI31	C65055-A667-A31
Flange with LL antielectrolytic coupling (500 kW)	RöEI32	Q1001-X129
Flange		Q1001-X82
Gasket ring for boiler		C65051-A410-C538

1) Measured by means of a 60 cm diameter screening plate in the screen grid terminal plane.

Anode and screen grid modulation, class C operation, grounded cathode circuit

Maximum ratings

Frequency	f	30	MHz
Anode voltage (dc)	U_A	13	kV
Screen grid voltage (dc)	U_{G2}	2200	V
Control grid voltage (dc)	U_{G1}	– 1000	V
Cathode current (dc)	I_K	50	A
Peak cathode current	$I_{K\,M}$	380	A
Anode dissipation	P_A	200	kW
Screen grid dissipation	P_{G2}	6,6	kW
Control grid dissipation	P_{G1}	1,4	kW

Operating characteristics

Frequency	f	≤ 30	MHz
Carrier power	P_{trg}	270	kW 1)
Anode voltage (dc)	U_A	12,5	kV
Screen grid voltage (dc)	U_{G2}	1200	V
Control grid bias (dc), fixed	$U_{G1\,fix}$	– 570	V
Control grid resistance	R_{G1}	125	Ω
Peak control grid voltage (ac)	$U_{g1\,m}$	940	V
Anode current (dc)	I_A	28	A
Screen grid current (dc)	I_{G2}	4,0	A
Control grid current (dc)	I_{G1}	1,2	A
Anode input power	$P_{B\,A}$	350	kW
Drive power	P_1	1,0	kW 1) 2)
Anode dissipation	P_A	80	kW 3)
Screen grid dissipation	P_{G2}	4,8	kW
Control grid dissipation	P_{G1}	0,14	kW
Efficiency	η	77	%
Anode load resistance	R_A	225	Ω
Modulation factor	m	100	%
Peak screen grid voltage (ac)	$U_{g2\,m}$	800	V 4)
Modulation power	P_{mod}	175	kW
Control grid current (dc)	I_{G1}	2,5	A 5)
Drive power	P_1	2,1	kW 1) 5)
Anode dissipation at modulation	$P_{A\,mod}$	150	kW 6)
Screen grid dissipation at modulation	$P_{G2\,mod}$	5,9	kW 6)

1) Circuit losses are not included.
2) Approx. 8 kW drive power at an initial load of 65 Ω on the tube input.
3) Even during modulation the indicated maximum ratings must not be exceeded. It has to be observed that during 100 % modulation the anode dissipation increases to about 1,5 times the power dissipation stated for the carrier value.
4) Modulation of screen grid via separate transformer winding.
5) Maximum values at $U_A = 0$ V.
6) Average values at $m = 100$ %.

AF amplifier and modulator, class B operation, 2 tubes in push-pull circuit

Maximum ratings

Anode voltage (dc)	U_A	15	kV
Screen grid voltage (dc)	U_{G2}	2200	V
Control grid voltage (dc)	U_{G1}	– 1000	V
Cathode current (dc)	I_K	50	A
Peak cathode current	$I_{K\,M}$	300	A
Anode dissipation	P_A	200	kW
Screen grid dissipation	P_{G2}	6,0	kW
Control grid dissipation	P_{G1}	1,4	kW

Operating characteristics at modulator operation for

		500 kW carrier power				
		$I_{G1} = 0$		$I_{G1} > 0$		
Output power	P_2	0	350	0	350	kW
Anode voltage (dc)	U_A	12,5	12,5	12,5	12,5	kV
Screen grid voltage (dc)	U_{G2}	2000	2000	1200	1200	V
Control grid voltage (dc)	U_{G1}	– 550	– 550	– 350	– 350	V
Peak control grid voltage (ac) between the 2 tubes	$U_{gg\,m}$	0	2 × 500	0	2 × 525	V
Anode current (dc)	I_A	2 × 2,5	2 × 22	2 × 3	2 × 22	A
Screen grid current (dc)	I_{G2}	0	2 × 0,6	0	2 × 2,1	A
Control grid current (dc)	I_{G1}	0	0	0	2 × 0,6	A
Anode input power	$P_{B\,A}$	2 × 31	2 × 275	2 × 38	2 × 275	kW
Drive power	P_1	0	0	0	2 × 290	W
Anode dissipation	P_A	2 × 31	2 × 100	2 × 38	2 × 100	kW
Screen grid dissipation	P_{G2}	0	2 × 1,1	0	2 × 2,5	kW
Control grid dissipation	P_{G1}	0	0	0	2 × 80	W
Efficiency	η	—	64	—	64	%
Effective load resistance (anode to anode)	R_{AA}	—	570	—	570	Ω

Tube mounting

Axis vertical, anode up.

For connection of the tube use the terminals listed under "Accessories".

When joining the connection rings to form a fixed socket, care has to be taken that the center deviation with respect to the common axis is less than 0,3 mm.

The transmitter is equipped with sliding rods, 20 mm in diameter, which ensure that the tube guided by the anode flange slips centrically into the socket. The contact blades for the heater current have to get into the right position with respect to the clamping jaws installed in the transmitter.

Before transporting the tube it has to be ensured that the water has been removed from the integrated boiler.

Maximum tube surface temperature

The temperature of the metal-ceramic seals must not exceed 200 °C at any point.

The maximum temperature difference at the circumference of the anode ceramic is 50 °C, whereas 80 °C are permissible in axial direction. The temperature gradient must not exceed 10 °C/cm. The surface temperature will remain below these maximum values if the air stream required for cooling of the terminals is directed along the anode ceramic.

In order to keep the temperature limit of 200 °C at the metal-ceramic seals, additonal cooling of the tube terminals is necessary. For this purpose an air stream of at least 6 m^3/min at a normal air pressure of 1 bar and 20 °C ambient temperature is conducted through the tube socket. At higher sea levels and ambient temperatures the minimum air flow rate must be increased proportionally.

After disconnecting the heater voltage, the tube terminals need an aftercooling time of 10 minutes. Thus the heat flow coming from the tube interior cannot cause impermissible heating up of the terminals and of the spring finger contacts of the connection rings. The aftercooling time can be cut to 5 minutes if the cooling air rate for ventilating the tube socket is increased to 8 m^3/min. The temperature of the curved part of the copper-beryllium spring finger contacts must not exceed 140 °C.

Vapor cooling

Cooling specification for maximum anode dissipation	$P_{A\,max}$ = 200 kW
Total power to be dissipated by the cooling system ($P_A + P_G + 0{,}8\ P_F$)	213 kW
Equivalent thermal output	12800 kJ/min (3060 kcal/min)
Flow rate of returning water	
at returning water temperature of 20 °C	approx. 4,9 l/min
at returning water temperature of 90 °C	approx. 5,6 l/min
Volume of generated vapor	
at returning water temperature of 20 °C	approx. 8,3 m^3/min
at returning water temperature of 90 °C	approx. 9,4 m^3/min

Detailed information on vapor cooling upon request. Please observe instructions on vapor cooling given under „Explanations on Technical Data".

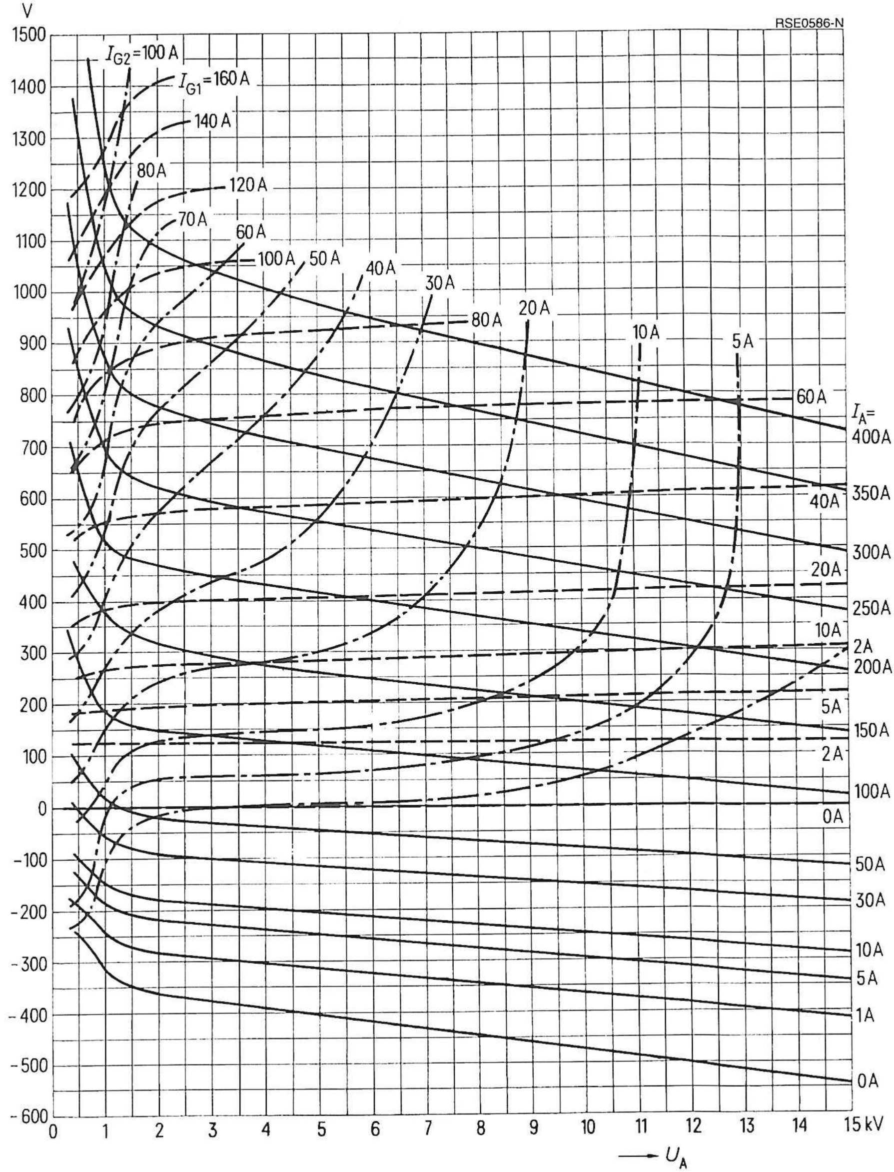
Safety precautions

The section "Safety precautions" under "Explanations on Technical Data" describes how the tube is to be protected against damage due to electric overload or insufficient cooling. A copper wire with 0,30 mm diameter should be used to test the anode overcurrent trip circuit.

For protection against thermal anode overload the tube fuse RöSich4 is recommended. In conjunction with pull switch RöKt11 it disconnects the voltages at the tube in case of overload (accessories).

$U_{G1} = f(U_A)$
$U_{G2} = 1200$ V

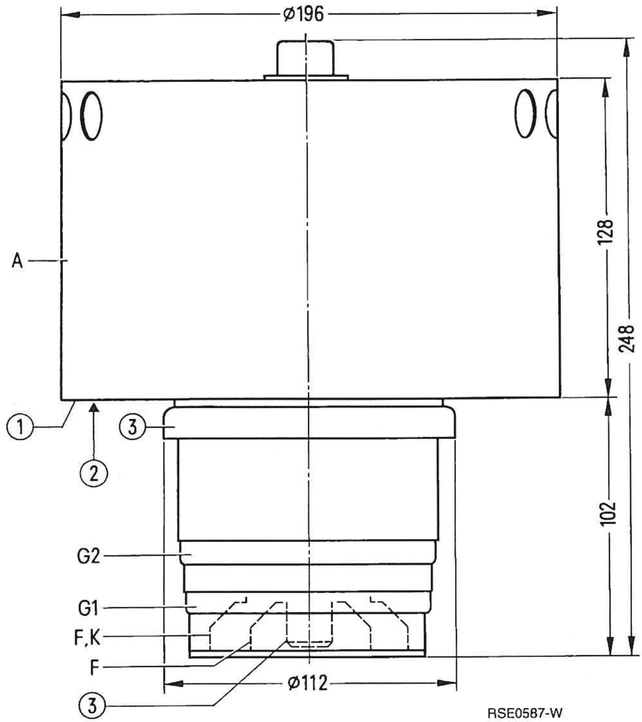
Parameter = I_A ———
Parameter = I_{G2} —·—·—
Parameter = I_{G1} — — —



VX

Ordering code Q51-X1500

Coaxial metal-ceramic tetrode, forced-air-cooled, for frequencies up to 110 MHz, particularly suitable for anode-modulated broadcast transmitters up to 20 kW.



Dimensions in mm

① Tube support
② Air inlet
③ Do not use as terminal

Approx. weight 11,5 kg

Heating

Heater voltage	U_F	7,5	V
Heater current	I_F	≈ 115	A
Heating: direct			
Cathode: thoriated tungsten			

Characteristics

Emission current at $U_A = U_{G2} = U_{G1} = 400$ V	I_{em}	28	A
Amplification factor of screen grid at $U_A = 3$ kV, $U_{G2} = 1250$ to 1500 V, $I_A = 1{,}8$ A	μ_{g2g1}	4,8	
Transconductance at $U_A = 3$ kV, $U_{G2} = 1250$ V, $I_A = 2$ A	S	35	mA/V

Capacitances

Cathode/control grid	c_{kg1}	≈ 70	pF
Cathode/screen grid	c_{kg2}	≈ 8,0	pF
Cathode/anode	c_{ka}	≈ 0,18	pF [1]
Control grid/screen grid	c_{g1g2}	≈ 85	pF
Control grid/anode	c_{g1a}	≈ 1,2	pF [1]
Screen grid/anode	c_{g2a}	≈ 28	pF

Accessories

		Ordering code
Socket (header connector)	RöFsg2795	Q1001-X28
Tube protective device	RöKt2	Q81-X1302

1) Measured by means of a 50 cm diameter screening plate in the screen grid terminal plane.

Anode and screen grid modulation, class C operation, grounded cathode circuit

Maximum ratings

Frequency	f	30	MHz
Anode voltage (dc)	U_A	8	kV
Screen grid voltage (dc)	U_{G2}	1000	V
Control grid voltage (dc)	U_{G1}	– 600	V
Cathode current (dc)	I_K	6,5	A
Peak cathode current	$I_{K\,M}$	28	A
Anode dissipation	P_A	15	kW
Screen grid dissipation	P_{G2}	350	W
Control grid dissipation	P_{G1}	75	W
Control grid resistance	R_{G1}	10	kΩ

Operating characteristics

Frequency	f	≤ 30	MHz
Carrier power	P_{trg}	22	kW 1)
Anode voltage (dc)	U_A	7,5	kV
Screen grid voltage (dc)	U_{G2}	800	V
Control grid bias (dc), fixed	$U_{G1\,fix}$	– 250	V
Control grid resistance	R_{G1}	4,5	kΩ
Peak control grid voltage (ac)	$U_{g1\,m}$	520	V
Anode current (dc)	I_A	3,7	A
Screen grid current (dc)	I_{G2}	0,3	A
Control grid current (dc)	I_{G1}	33	mA
Anode input power	$P_{B\,A}$	27,7	kW
Drive power	P_1	16	W 1)
Anode dissipation	P_A	5,7	kW 2)
Screen grid dissipation	P_{G2}	240	W
Control grid dissipation	P_{G1}	2,3	W
Efficiency	η	79,5	%
Anode load resistance	R_A	1080	Ω
Modulation factor	m	100	%
Peak screen grid voltage (ac)	$U_{g2\,m}$	400	V 3)
Modulation power	P_{mod}	13,8	kW
Control grid current (dc)	I_{G1}	74	mA 4)
Drive power	P_1	35	W 1)4)
Anode dissipation at modulation	$P_{A\,mod}$	8,5	kW 5)
Screen grid dissipation at modulation	$P_{G2\,mod}$	295	W 5)

1) Circuit losses are not included.
2) Even during modulation the indicated maximum ratings must not be exceeded. It has to be observed that during 100 % modulation the anode dissipation increases to about 1,5 times the power dissipation stated for the carrier value.
3) Modulation of screen grid via separate transformer winding.
4) Maximum values at $U_A = 0$ V.
5) Average values at $m = 100$ %.

Tube mounting

Axis vertical, anode up or down.

For connection of the tube use the connectors listed under "Accessories".

Maximum tube surface temperature

The temperature of the metal-ceramic seals must not exceed 200 °C at any point and the temperature of the anode body must not exceed 220 °C. If an appropriate air duct is provided the cooling air or part of it can be used to keep the maximum permissible temperature of the metal-ceramic seals.

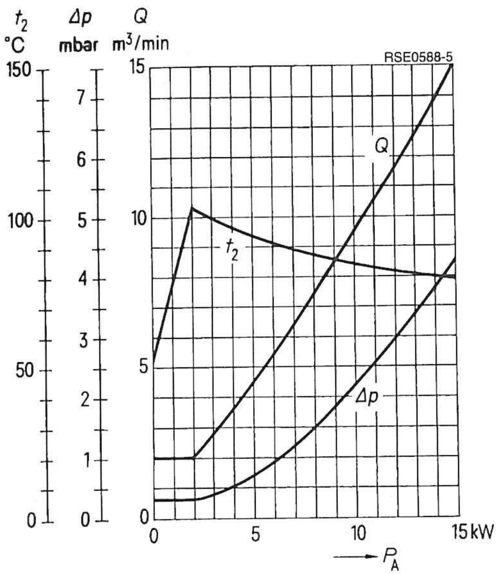
Forced-air cooling

The minimum air flow rate required for maximum anode dissipation is given in the cooling air diagram valid for 25 °C inlet temperature at a normal air pressure of 1 bar (sea level). The cooling air must be supplied from the side of the electrode terminals. For further information on forced-air cooling refer to "Explanations on Technical Data".

Safety precautions

The section "Safety precautions" under "Explanations on Technical Data" describes how the tube is to be protected against damage due to electric overload or insufficient cooling. A copper wire with 0,20 mm diameter should be used to test the anode overcurrent trip circuit.

Cooling air diagram



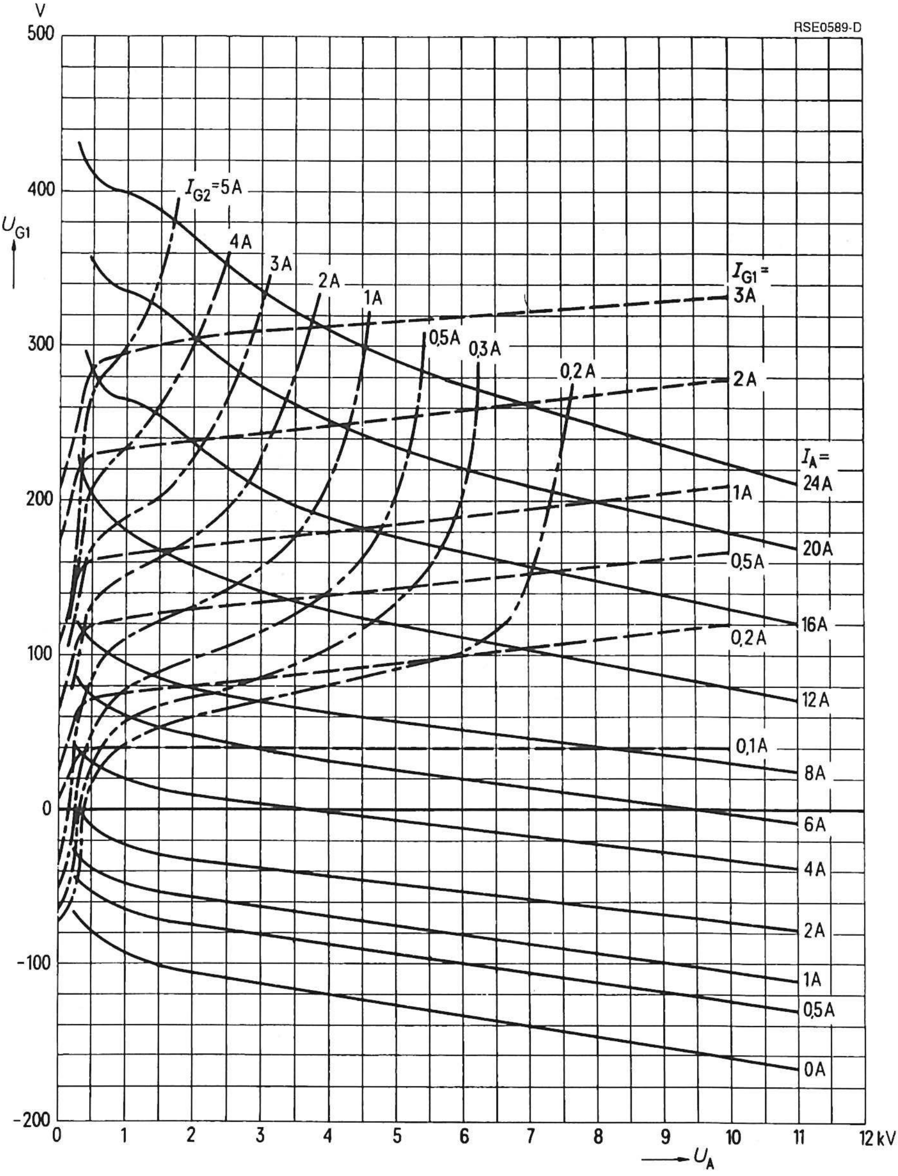
The cooling air is supplied from the electrode terminal side.

Air pressure = 1 bar

t_1 = 25 °C

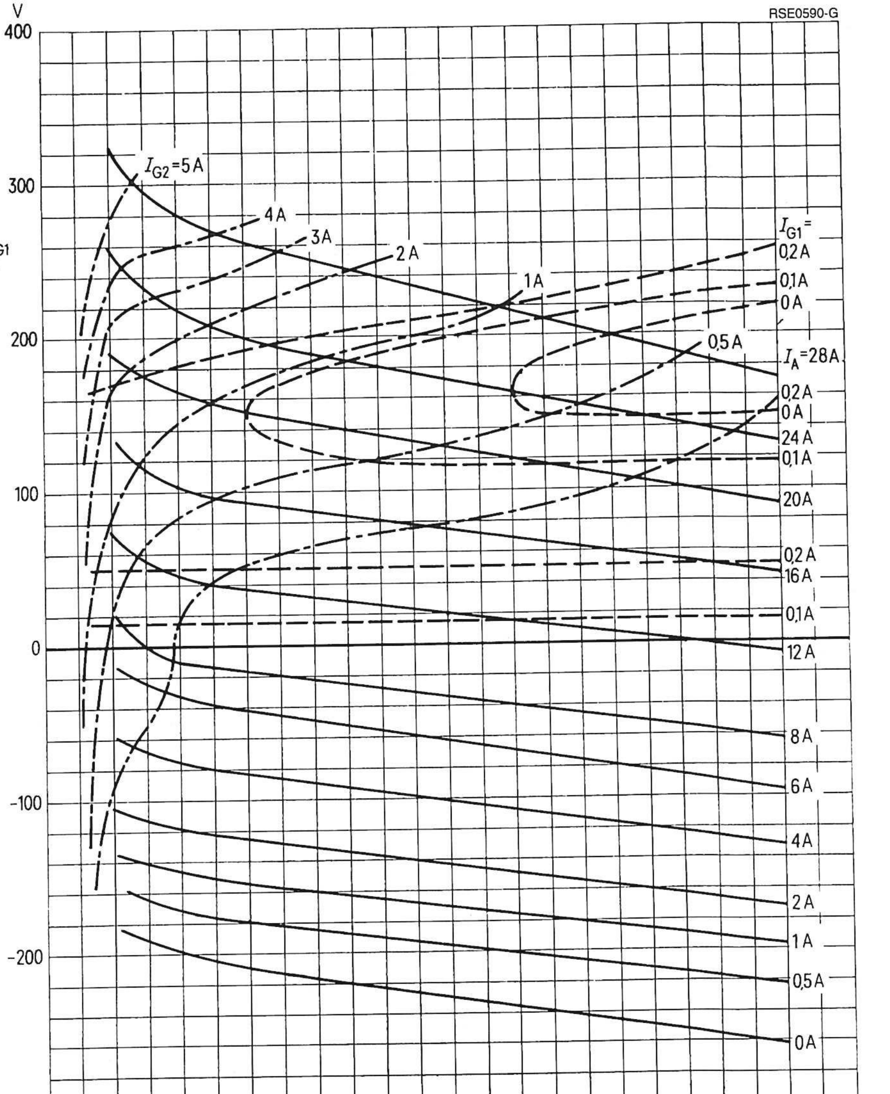
$U_{G1} = f(U_A)$
$U_{G2} = 400$ V

Parameter = I_A ————————
Parameter = I_{G2} —·—·—·—·—
Parameter = I_{G1} — — — — — —



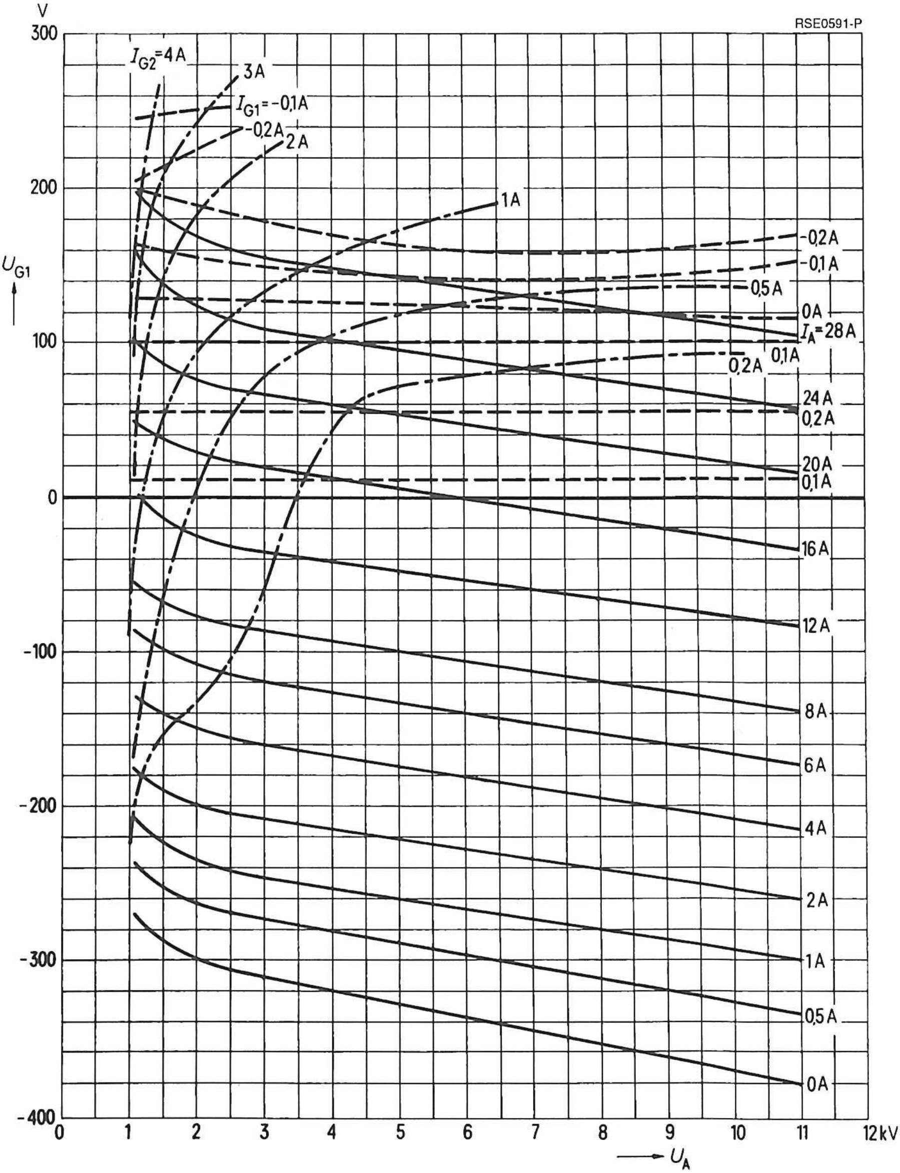
$U_{G1} = f(U_A)$
$U_{G2} = 800$ V

Parameter = I_A ———
Parameter = I_{G2} —·—·—
Parameter = I_{G1} — — —



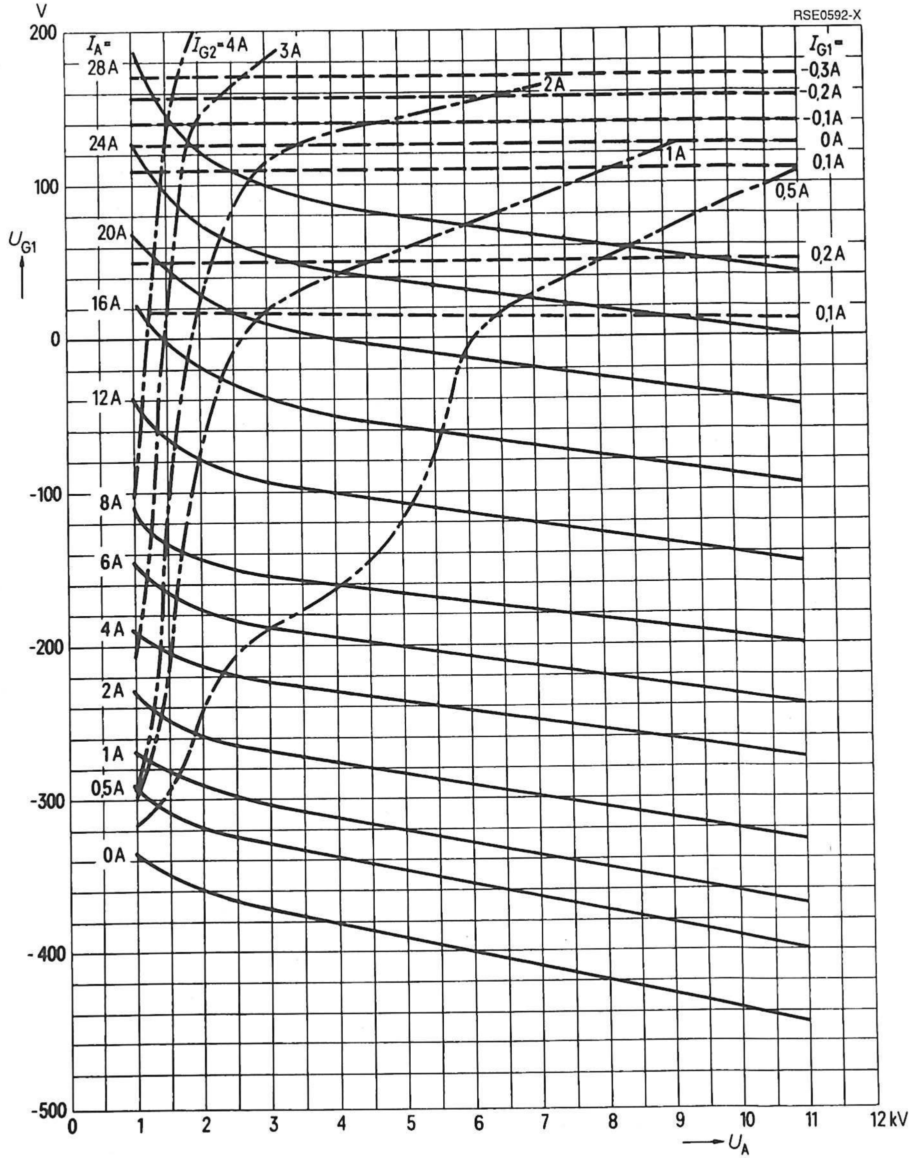
$U_{G1} = f(U_A)$
$U_{G2} = 1200$ V

Parameter = I_A ————
Parameter = I_{G2} —·—·—·—
Parameter = I_{G1} — — — —



$U_{G1} = f(U_A)$
$U_{G2} = 1500$ V

Parameter = I_A ———
Parameter = I_{G2} —·—·—
Parameter = I_{G1} — — —



Earlier Models Still Available
(Not for new design)

Type	Ordering code	Heating		Characteristics		Maximum ratings	
		U_F V	I_F A	µ	s mA/V	P_A kW	f MHz
RS 523 **RS 723** **RS 823**	Q52-X523 Q51-X723 Q53-X823	6,5	180	52	30	25 20 35	30
RS 526 **RS 726** **RS 826**	Q52-X526 Q51-X726 Q53-X826	11	155	90	60	50 35 60	30
RS 533 **RS 733** **RS 833**	Q52-X533 Q51-X733 Q53-X833	5	80	33	33	7 7 10	30
RS 732	Q51-X732	10	44	30	20	2,5	100
RS 782	Q51-X782	10	44	6,2	15	2,5	30
RS 783	Q51-X783	10	44	8,4	20	2,5	30
RS 822	Q53-X822	5	150	62	55	30	30
RS 873	Q53-X873	6,5	180	12,5	25	40	3
RS 1001 L **RS 1001 V**	Q51-X1001 Q53-X1001	5	140	65	40	10 15	100
RS 1002 A	Q54-X1002	5	14	5,1	4	0,4	110
RS 1003	Q54-X1003	6,3	2,3	20	18	0,06	100
RS 1007	Q54-X1007	5	6,5	6,2	2,2	0,125	200
RS 1012 L **RS 1012 V**	Q51-X1012 Q53-X1012	5	64	5,2	22	4 6	230
RS 1031 L **RS 1031 V**	Q51-X1031 Q53-X1031	10	140	58	56	25 50	30

1) TV vision transmitter
2) Peak sync.
3) Pulse peak values
4) Circuit losses are not included
5) Power transition of grounded grid circuit included
6) TV translator with combined vision/sound transmission
7) Anode-modulated pulse operation
8) Industrial generator
9) Broadcast transmitter, RF driver/final stage
10) Broadcast transmitter, amplitude modulation

Operating mode	Operating characteristics						
	U_A kV	I_A A	U_{G1} V	U_{G2} V	$U_{g\,m}$ V	P_1 W [4]	P_2 kW [4]
C [8] C [8] C [9]	11 10 11	5 5 4,75	– 500 – 450 – 500		970 920 970	800 780 800	40 36 40
C [8] C [9] C [10]	12 12 10	8,7 11 5,9	– 280 – 300 – 120		780 820 1020	935 2000 2000	75 100 50
C [8] C [8] C [9]	10 8 10	1,9 1,5 1,45	– 500 – 430 – 690		650 550 840	130 80 178	15 9 12
C	4	1,2	– 200		500	600	3,5
B	4	1,2	– 200	500	440	31,5	3,5
B	5,7	0,86	– 62	600	90	3,6	3,1
C	8	4,8	– 240		535	535	30
B	12	6,5	– 910		1280	160	90
B	6	2,5	– 100		280	640 [5]	11
C	4	0,35	– 220	500	305	1,8	1,1
C	0,8	0,2	– 35	380	50	0,7	0,105
C	3	0,167	– 150	350	300	2	0,375
B	4	1,4	– 110	600	220	60	3,3
C	12 10	7,2 5,6	– 550 – 450		900 780	1180 1350	70 42 [10]

Earlier Models Still Available
(Not for new design)

Type	Ordering code	Heating		Characteristics		Maximum ratings	
		U_F V	I_F A	μ	s mA/V	P_A kW	f MHz
RS 1032 C	Q51-X1032	4,1	130	6	40	12	860
RS 1041 W	Q52-X1041	18	280	55	130	120	10
RS 1052 C	Q51-X1052	3,2	80	4,6	19	3,5	790
RS 1061 L **RS 1061 W**	Q51-X1061 Q52-X1061	10	52	50	14	8	30
RS 1062 C 7650, YL 1110	Q51-X1062	6,3	6,5	13	22	0,7	790
RS 1072 C	Q51-X1072	3,8	20,5	11	43	1,8	250
RS 1081 W	Q52-X1081	8	115	45	35	20	30
RS 1082 CW	Q52-X1082	10	200	6,6	65	30	230
RS 2001 W	Q52-X2001	18	164	50	110	60	30
RS 2021 L	Q51-X2021	12,6	160	58	60	35	60
RS 2052 CJ	Q52-X2052	16	260	5	90	120	110
RS 2072 V	Q53-X2072	11,6	1270	4,5	380	330	30
YL 1042	Q51-X1042	6,3	1,05	18	20	0,115	860
YL 1050	Q51-X1050	3,8	20,5	10,5	41	1,6	790
YL 1052	Q51-X1049	3,8	20,5	9,5	41	1,8	1215

Detailed data upon request

1) TV vision transmitter
2) Peak sync.
3) Pulse peak values
4) Circuit losses are not included
5) Power transition of grounded grid circuit included
6) TV translator with combined vision/sound transmission
7) Anode-modulated pulse operation
8) Industrial generator
9) Broadcast transmitter, RF driver/final stage
10) Broadcast transmitter, amplitude modulation

Operating mode	Operating characteristics						
	U_A kV	I_A A	U_{G1} V	U_{G2} V	$U_{g\,m}$ V	P_1 W [4]	P_2 kW [4]
B	5	3,4	– 110	800	170	700	11,5 [2]
C [8]	15	29,3	– 520		1090	5500	360
B [1]	3,3	1,3		600	220	400	2,2 [2]
C [8]	8	2	– 400		875	430	12
B [1]	2	0,22	– 35	400		28	0,28
AB	3	0,7	– 35	500	35		1,1
C [8]	12	4,6	– 450		780	685	45
B [1]	5,4	6	– 95	800	190	1200 [5]	26 [2]
C [8]	12	17,1	– 600		1100	4000	165
C	15	9,75	– 600		1000	2100	120
C	11	12,4	– 600	800	820	590	110 [10]
C	12	60	– 750	1200	1000	2700	550 [10]
AB_1 [6]	0,9	0,12	– 10	300		0,6	0,02 [2]
B	2,25	0,8		500		50	1 [2]
B	2,3	1,1		500		40	1,2 [2]

Siemens in Ihrer Nähe
Siemens Worldwide

Siemens AG
Passive Bauelemente
und Röhren
Vertrieb
Postfach 10 11 15
40002 Düsseldorf
☎ (02 11) 3 99-25 89
FAX (02 11) 3 99-25 40

Siemens AG
Passive Bauelemente
und Röhren
Vertrieb
Postfach 20 21 09
80286 München
☎ (0 89) 92 21-0
FAX (0 89) 92 21-43 90

Siemens AG
Passive Bauelemente
und Röhren
Vertrieb
Postfach 10 60 26
70049 Stuttgart
☎ (07 11) 137-0
FAX (07 11) 137-20 37

— Vertriebsregionen

Europa/Europe

Belgien/Belgium
Siemens S.A.
Chaussée de Charleroi 116
1060 Bruxelles
☎ (02) 5 36-21 11, Tx 21347
FAX (02) 5 36-24 92

Dänemark/Denmark
Siemens A.S.
Borupvang 3
2750 Ballerup
☎ (45) 44 77 44 77
FAX (45) 44 77 40 17

Finnland/Finland
Siemens Components
PL 60
02601 Espoo
☎ (90) 5 10 51, Tx 1001228
FAX (90) 51 05 24 95

Frankreich/France
Siemens S.A.
Division Composants
39-47, Boulevard Ornano
93527 Saint Denis Cedex 2
☎ (1) 49 22-31 00
FAX (1) 49 22-36 55

Griechenland/Greece
Siemens AE
Paradissou & Artemidos
P.O.B. 61011
15110 Amaroussio
☎ (01) 68-64-2 40
FAX (01) 68-64-2 11

Großbritannien/Great Britain
Siemens House
Electronic Components
Oldbury / Bracknell
Berkshire RG 12 8 FZ
☎ (0) 13 44 39 60 00
FAX (0) 13 44 39 67 24

Irland/Ireland
Siemens Ltd. Dublin
ECD
8 Raglan Road
Ballsbridge
Dublin 4
☎ (01) 6 03-23 48
FAX (01) 6 03-23 49

Italien/Italy
Siemens S.P.A.
Via dei Valtorta 48
20127 Milano
☎ (02) 6 67 61, Tx 330261
FAX (02) 66 76 43 80

Niederlande/Netherlands
Siemens Nederland N.V.
Postbus 1 60 68
2500 BB Den Haag
☎ (0 70) 3 33 33 33
FAX (0 70) 3 33 28 15

Norwegen/Norway
Siemens Components
Østre Aker vei 90
Postboks 10, Veitvet
0518 Oslo
☎ (22) 63 30 00
FAX (22) 68 49 13

Österreich/Austria
Siemens AG
Postfach 3 26
1031 Wien
☎ (0) 1-17 07-3 68 57
FAX (0) 1-17 07-5 53 38

Polen/Poland
Siemens Sp.z.o.o
ul. Zupnicza 11
P.O.B. 159
03821 Warszawa
☎ (0 48 22) 6 70 90 00
FAX (0 48 22) 6 70 90 09

Portugal
Siemens S.A.
Divisao de Componentes
Apartado 6 03 00
2700 Amadora
☎ (01) 4 17 80 00
FAX (01) 4 17 80 83

Schweden/Sweden
Siemens Components
Box 46, S-16493 Kista
☎ (08) 7 03 35 00
FAX (08) 7 03 35 01

Schweiz/Switzerland
Siemens Schweiz AG
Freilagerstraße 28
8047 Zürich
☎ (01) 4 95-31 11
FAX (01) 4 95-50 50

Spanien/Spain
Siemens S.A.
Dpto. Componentes
Ronda de Europa, 3
28760 Tres Cantos - (Madrid)
☎ (0034)1 8 03 00 85/8 03 12 00
FAX (0034)1 8 03 39 26/8 03 54 26

Tschechische und Slowakische Republik
Siemens SRO
Na Strži 40
14000 Praha 4
☎ (02) 61 09 51 11
FAX (02) 61 21 50 32

Türkei/Turkey
SIMKO Ticaret ve Sanayi A.Ş
Meclisi Mebusan Cad. 125
80040 Findikli-Istanbul
☎ (212) 2 51 09 00, Tx 24333
FAX (212) 2 49 49 53

Ungarn/Hungary
SIMACOMP Kft
Postfach 191
Lajos Utca 103
1036 Budapest
☎ (01) 4 57 16 90
FAX (01) 4 57 16 92

Afrika/Africa

Südafrika/ Republic of South Africa
Siemens Components Ltd.
P.O.B. 34 38
1685 Halfway House
☎ (0 11) 3 15 19 50
FAX (011) 3 15 19 68

Amerika/America

Argentinien/Argentina
Siemens S.A.
Av. Fondo de la Legua 2513
1607 Villa Adelina -
Pcia de Buenos Aires
☎ (01) 7 38-71 42
FAX (01) 7 38-71 44

Brasilien/Brazil
Icotron S.A.
Indústria de Componentes
Electronicos
Caixa Postal 1375,
05110-901 São Paulo-SP Brazil
☎ (55 11) 8 36-22 11
FAX (55 11) 8 36-26 31

Kanada/Canada
Siemens Electronic Components
Promotion
300 March Rd. - Suite 503
Kanata, Ont. K2K 2E2
☎ (001) 613-591 63 87
FAX (001) 613-591 63 89

USA
Passive Components;
Tube Products:

Siemens Components, Inc.
186 Wood Avenue South
Iselin, New Jersey 08830-2770
☎ (9 08) 9 06-43 00
FAX (9 08) 6 32-28 30

Optical and Acoustical Crystals;
SAW, E-O, and A-O Devices;
Integrated Optics Devices:

Crystal Technology, Inc.
1040 East Meadow Circle
Palo Alto, CA 94303-4230
☎ (4 15) 8 56-79 11
FAX (4 15) 4 24-88 06

Asien/Asia

China
Siemens Components Ltd., Beijing Office
Rm 2106, Building A, Vantone New World
Plaza No.2 Fu Cheng Men
Wai Da Jie, 100037 Beijing
☎ (86) 10 68 57 90 06
FAX (86) 10 68 57 90 08

Siemens Components Ltd.
Shanghai Office, Rm 811 Admiralty Bldg.
680 Zhao Jia Bang Road
Shanghai
☎ (86) 21 64 73 80 68
FAX (86) 21 64 73 25 71

Hong Kong
Siemens Components Ltd.
23/F., Tai Yau Building
181 Johnston Road, Wanchai
Hong Kong
☎ (8 52) 28 32-05 00
Tx (8 52) 28 27-84 21

Indien/India
Siemens Ltd., Head Office
134-A, Dr. Annie Besant Road, Worli
P.O.B. 65 97
Bombay 400018
☎ (91) 22-4938786, FAX (91) 22-4 93 99 07

Indonesien/Indonesia
C. V. Schmidt Mitra Indonesia
DELTA Building Block A No. 30
Jl. Suryopranoto No. 1-9
Jakarta 10160
☎ (6221) 38 07-845
FAX (6221) 38 07-847

Japan
Fuji Electronic Components Ltd.
Passive Components and Tubes
Shinjuku Koyama Bldg. 2F
30-3, Yoyogi 4-chome Shibuya-ku
Tokyo 151
☎ (03) 5388-8514
FAX (03) 3376-9792

Korea
Siemens Ltd.
10th Floor, Asia Tower Bldg.
726 Yeoksam-dong, Kangnam-Gu
C. P. O Box 3001
Seoul 135-080
☎ (822) 5277-740
FAX (822) 5277-779

Malaysia
Siemens Components Pte Ltd.
c/o Siemens Semiconductor
Sdn Bhd, Bayan Lepas Free
Trade Zone, Penang 11900
☎ (604) 64 40-045
FAX (604) 64 40-379

Hamilton Electronics
Kuala Lumpur Office
No. E-3, Bangunan Khaz
Jalan 8/1E, 46050 Petaling Jaya
Selangor Darul Ehsan
☎ (603) 75 65-286
FAX (603) 75 65-875

Hamilton Electronics Sdn Bhd
Penang Office
1st Floor, No. 40 Jalan Mahsuri
Bayan Baru
Penang 11950
☎ (604) 64 51-620
FAX (604) 64 51-629

Serial System Sdn Bhd
Penang Office
No. 14, Jalan Sultan Azlan Shah
Gelngor 11700, Pulau Pinang
☎ (604) 65 70-204
FAX (604) 65 62-762

Philippinen/Philippines
Hamilton Electronics Pte. Ltd.
Philippines Representative Office
Unit 1114,Cityland Condominium 10
6815 Ayata Avenue, Makati
Metro, Manila
☎ (632) 81 29-999
FAX (632) 81 29-999

Singapur/Singapore
Siemens Components Pte. Ltd.
PR Division
Block164 Kallang Way #05-01/12
Singapore 349248
☎ (65) 74 47-768
FAX (65) 744 6-992

Hamilton Electronics Pte. Ltd.
159, Sin Ming Road #06-04.
Amtech Building
Singapore 575625
☎ (65) 55 28-266
FAX (65) 55 28-277

Serial System Pte. Ltd.
11, Jalan Mesin #06-00
Standard Industrial Building
SIngapore 368813
☎ (65) 28 00-200
FAX (65) 28 61-812

Thailand
Schmidt Scientific Ltd.
69/5 Soi Sueksavittaya
North Sathom Road
Bangkok 10500
☎ (662) 23 70 923-24
FAX (662) 23 72-627

Taiwan
Tai Engineering Co. Ltd.
6th Fl., Central Building
108, Chung Shan North Road, Sec.2,
Taipeh
☎ (886) 25 23-47 00
FAX (886) 25 36-70 70

Australien/Australia

Siemens Ltd.
Head Office
5 44 Church Street
Richmond (Melbourne), Vic.3121
☎ (61-3) 94 20-77 16
FAX (61-3) 94 20-72 75

Herausgegeben von Siemens AG, Bereich Passive Bauelemente und Röhren 07.96
Marketing Kommunikation, Postfach 80 17 09, D-81617 München
☎ (0 89) 41 44-0 Tx 52108-0 sie d FAX (0 89) 41 44-26 89

Published by Siemens AG, Bereich Passive Bauelemente und Röhren
Marketing Kommunikation, Postfach 80 17 09, D-81617 München
☎ (0 89) 41 44-0 Tx 52108-0 sie d FAX (0 89) 41 44-26 89

blank page

Published by Siemens AG, Bereich Passive Bauelemente und Röhren
Marketing Kommunikation

Ordering No. B442-P4213-X-X-7600
Printed in Germany
DB 07962.

VX